



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

QB
301
U5
no. 13
1922

UC-NRLF



B 3 957 195

CALIFORNIA-WASHINGTON ARC OF
PRECISE TRIANGULATION
A. L. BALDWIN



Photom
Pamph
Binder
Gaylord Bros
Makers
Stockton, Ca
PAT. MAR. 21, 1908

Digitized by Google

Serial No. 196

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

**CALIFORNIA-WASHINGTON ARC OF
PRECISE TRIANGULATION**

Special Publication No. 13
(Second Edition)

By

A. L. BALDWIN



PRICE, 10 CENTS

Sold only by the Superintendent of Documents, Government Printing Office
Washington, D. C.

**WASHINGTON
GOVERNMENT PRINTING OFFICE
1922**

**LIBRARY
UNIVERSITY OF CALIFORNIA
DAVIS**

Digitized by Google

DB 296
 U.S.A.S.
 200.13
 Library

CONTENTS.

General statement.....	Pa.
Field work.....	
Least-squares adjustment.....	
Accord of bases.....	
Accord of azimuths.....	
The North American datum.....	
Explanation of positions, lengths and azimuths, and of the North American datum.....	
Use of horizontal control data.....	
Explanation of tables.....	
Arrangement of tabulated data.....	
Explanation of lengths.....	
Azimuth and back azimuth.....	
Accuracy of data indicated in tables.....	
How to find the data desired.....	
Related publications.....	
Geographic positions.....	
Elevations.....	
Descriptions of stations.....	
Marking of stations.....	
Conversion tables.....	
Sketches.....	
Index to positions, descriptions, elevations, and sketches.....	

ILLUSTRATIONS.

- Fig. 1. Index map showing areas in the United States covered by published triangulation which has been rigidly computed on the North American datum.....
- Fig. 2. Index map of the California-Washington Arc.....
- Fig. 3. Triangulation, thirty-ninth parallel to vicinity of Redding, Calif.....
- Fig. 4. Triangulation, vicinity of Redding, Calif., to southern Oregon.....
- Fig. 5. Triangulation, southern Oregon to vicinity of Eugene, Oreg.....
- Fig. 6. Triangulation, vicinity of Eugene, Oreg., to vicinity of Portland, Oreg.....
- Fig. 7. Triangulation, vicinity of Portland, Oreg., to Tacoma, Wash.....

ENGINEERING LIBRARY

THE CALIFORNIA-WASHINGTON ARC OF PRECISE
TRIANGULATION.QB296
US A45
no. 13EARTH
SCIENCES
LIBRARY

GENERAL STATEMENT.

The arc of precise triangulation, the results of which are here published, extends from latitude 39° , in northern California, to Puget Sound, Wash. The data for this arc, together with a discussion of the least-squares adjustment and other purely scientific matter, were originally published in United States Coast and Geodetic Survey Special Publication No. 13, by A. L. Baldwin, computer. The original publication is now exhausted, and there is reprinted here only that part of the data which is of value to the engineer or surveyor for the control of surveys, namely, the geographic positions, elevations, and descriptions of stations.

FIELD WORK.

Early in 1903 Assistant O. B. French organized a reconnaissance and signal-building party at Eugene, Oreg. With this party Mr. French made a reconnaissance through the Willamette Valley to connect with the triangulation of the Columbia River. He then returned to Eugene with part of the party to do the observing, leaving the rest of the party to build the signals. The observing was carried as far as the reconnaissance had been completed by the latter part of September. Both parties then returned to Eugene, where a base net was laid out and partly observed. Mr. French then made a reconnaissance to the southward to connect with the precise triangulation along the thirty-ninth parallel, which he completed by the middle of November.

In 1904 Assistant J. S. Hill was also assigned to the work, thus allowing Mr. French to devote more time to the reconnaissance without delay to the observing party. The observing started at Marysville Butte soon after May 1, and the season closed about the middle of November. During this time the whole scheme was completed between the transcontinental triangulation along the thirty-ninth parallel and the work of the previous season. Mr. French spent about a month of this season in making a reconnaissance from the Columbia River to Puget Sound.

During the season of 1905 the organization of the parties was the same as in the previous season. The work of this season started in the vicinity of the Columbia River, but though every effort was made, the work was not completed to a connection with the Puget Sound triangulation. This was partly due to the bad weather and to the difficult character of the country, and was partly due to the necessity of revising the reconnaissance in order to eliminate some very high signals and an excessive amount of cutting of timber.

The work of the last season, 1906, was in charge of Assistant J. S. Hill, who organized the party on June 1st and completed the work on July 26.

915558

THE LEAST-SQUARES ADJUSTMENT.

The geographic positions of Snow Mountain West and Mount Helena, together with the length and azimuth of the line between them, was held fixed as determined by the thirty-ninth parallel triangulation. A single least-squares adjustment served for the entire precise scheme. The Willamette base and the Tacoma base required the use of two length equations, and the Laplace azimuths at Gazelle, Willamette, and Tacoma necessitated three azimuth equations. The maximum correction to a direction, from the adjustment, was $2''.03$, and the probable error of an observed direction was $\pm 0''.53$. The average closing error of the 148 triangles was $1''.22$.

ACCORD OF BASES.

There are three bases which serve to fix the lengths in the triangulation discussed in this report.

The Yolo base in the thirty-ninth parallel triangulation fixed the length of the line Snow Mountain West-Mount Helena and also the other two sides of triangle Snow Mountain West-Marysville Butte-Mount Helena. The Willamette and Tacoma bases furnish two important tests of the accuracy of the triangulation.

In solving the normal equations in each section of the figure adjustment the length equation was, as usual, assigned to the last place, so that after all the conditions relating to triangle closures and ratios of length had been satisfied the discrepancy in length became known. In the following table the discrepancies developed between bases are given in terms of the seventh place of logarithms and are also expressed as ratios. A plus sign before the discrepancy expressed in terms of logarithms means that the first base mentioned is longer as measured than as computed through the intervening triangulation from the second base mentioned.

Bases	Discrepancy in seventh place of loga- rithms	Discrepancy expressed as a ratio
Mount Helena-Snow Mountain West to Willamette base.....	+79	1-55000
Willamette base to Tacoma base.....	-19	1-229000

ACCORD OF AZIMUTHS.

True geodetic azimuths were determined at three Laplace stations, viz, at Gazelle astronomic, Eugene astronomic, and Tacoma astronomic. In each case the true geodetic azimuth as held fixed was larger than the azimuth as computed through the triangulation, the direction of the computation being from the south to the north. At Gazelle astronomic the discrepancy was $3''.14$, at Eugene astronomic $2''.98$, and at Tacoma astronomic $3''.95$.

THE NORTH AMERICAN DATUM.

Concerning the actual use of the table of geographic positions, it is necessary to explain the "North American datum," which serves as the basis for all the geodetic values in this report.

Early in the year 1913 the Superintendent of the U. S. Coast and Geodetic Survey was notified by the director of the Comisión Geodésica Mexicana and by the chief astronomer of the Dominion of Canada Astronomical Observatory that the so-called United States standard datum had been adopted as the datum for the triangulation of those organizations. They also reported that the Clarke spheroid of 1866, now used in the United States, would be used by them.

Owing to the international character of the datum adopted by the three countries, the Superintendent of the U. S. Coast and Geodetic Survey changed its designation from the "United States standard datum" to the "North American datum."

EXPLANATION OF POSITIONS, LENGTHS, AND AZIMUTHS, AND OF THE
NORTH AMERICAN DATUM.

All of the positions and azimuths have been computed upon the Clarke spheroid of 1866, as expressed in meters, which has been in use in the U. S. Coast and Geodetic Survey for many years.

After a spheroid has been adopted and all the angles and lengths in a triangulation have been fully fixed it is still necessary, before the computation of latitudes, longitudes, and azimuths can be made, to adopt a standard latitude and longitude for a specified station and a standard azimuth of a line from that station. For convenience the adopted standard position (latitude and longitude) of a given station, together with the adopted standard azimuth of a line from that station, is called the geodetic datum.

The triangulation in the United States was commenced at various points and existed at first as a number of detached portions in each of which the geodetic datum was necessarily dependent only upon the astronomic stations connected with that particular portion. As examples of such detached portions of triangulation there may be mentioned the early triangulation in New England and along the Atlantic coast, a detached portion of the transcontinental triangulation centering on St. Louis and another portion of the same triangulation in the Rocky Mountain region, and three separate portions of triangulation in California, in the latitude of San Francisco, in the vicinity of Santa Barbara Channel and in the vicinity of San Diego. With the lapse of time these separate pieces expanded until they touched.

The transcontinental triangulation, the office computation of which was completed in 1899, joined all the detached portions mentioned and made them one continuous triangulation. As soon as this took place the logical necessity existed of discarding the old geodetic data used in these various pieces and substituting one for the whole country, or at least for as much of the country as is covered by continuous triangulation. To do this was a very tedious piece of work and involved much preliminary study to determine the best datum to be adopted. On March 13, 1901, the superintendent adopted what was known from that time until 1913 as the United States standard datum, but is now known as the North American datum, and it was decided to reduce the positions to that datum as rapidly as possible. The datum adopted was that formerly in use in New England, and therefore its adoption did not affect the positions which had been used for geographic purposes in New England and along the Atlantic coast to North Carolina, nor those

in the States of New York, Pennsylvania, New Jersey, and Delaware. The adopted datum does not agree, however, with that used in the Transcontinental Triangulation and in the Eastern Oblique Arc of the United States, publications which deal primarily with the purely scientific problem of the determination of the figure of the earth and which were prepared for publication before the adoption of the new datum.

As the adoption of such a standard datum was a matter of considerable importance, it is in order here to explain the desirability of this step more fully.

The main objects to be attained by the geodetic operations of the U. S. Coast and Geodetic Survey are, first, the control of the charts published by the Survey; second, the furnishing of the geographic positions (latitudes and longitudes), of accurately determined elevations, and of distances and azimuths, to officers connected with the Survey and to other organizations; third, the determination of the figure of the earth. For the first and second objects it is not necessary that the reference spheroid should be accurately that which most closely fits the geoid within the area covered, nor that the adopted geodetic datum should be absolutely the best that can be derived from the astronomic observations at hand. It is simply desirable that the reference spheroid and the geodetic datum adopted shall be, if possible, such a close approximation to the truth that any correction which may hereafter be derived from the observations which are now, or may become, available shall not greatly exceed the probable errors of such corrections. It is, however, very desirable that one spheroid and one geodetic datum be used for the whole country. In fact, this is absolutely necessary if a geodetic survey is to perform fully the function of accurately coordinating all surveys within the area which it covers. This is the most important function of a geodetic survey. To perform this function, it is also highly desirable that when a certain spheroid and geodetic datum have been adopted for a country they be rigidly adhered to, without change for all time unless shown to be largely in error.

In striving to obtain the third object, the determination of the figure of the earth, the conditions are decidedly different. This problem concerns itself primarily with astronomic observations of latitude, longitude, and azimuth and with the geodetic positions of the points at which the astronomic observations were made, but is not concerned with the geodetic positions of other points fixed by the triangulations. The geodetic positions (latitudes and longitudes) of comparatively few points are therefore concerned in this problem. However, in marked contrast to the statements made in preceding paragraphs, it is desirable in dealing with this problem that with each new important accession of data, a new spheroid fitting the geoid with the greatest possible accuracy, and new values of the geodetic latitudes, longitudes, and azimuths of the highest degree of accuracy should be derived.

The North American datum was adopted with reference to positions furnished for geographic purposes but has no reference to the problem of the determination of the figure of the earth. It was adopted with reference to the engineer's problem of furnishing standard positions and does not affect the scientist's problem of the determination of the figure of the earth.

The principles which guided in the selection of the datum to be adopted were: First, that the adopted datum should not differ widely from the ideal datum for which the sum of the station errors in latitude, longitude, and azimuth should each be zero; second, it was desirable that the adopted datum should produce minimum changes in the publications of the U. S. Coast and Geodetic Survey, including its charts; and third, it was desirable, other things being equal, to adopt that datum which allowed the maximum number of positions already in the office files to remain unchanged, and therefore necessitated a minimum amount of new computation. These considerations led to the adoption, as the standard, of that datum which had been in use for many years in the northeastern group of States and along the Atlantic coast as far south as North Carolina.

An examination of the station errors of the astronomical stations so far reduced, scattered widely over the United States from Maine to Louisiana and to California, indicated that this datum approaches closely the ideal for which the algebraic sum of the station errors of each class would be zero.

The North American datum, upon which the positions and azimuths given in this publication depend, may be defined in terms of the position of the station Meades Ranch, Kansas, as follows:

$$\begin{array}{rcl} \phi = 39 & 13 & 23.686 \\ \lambda = 98 & 32 & 30.506 \\ a \text{ to Waldo} = 75 & 28 & 14.52 \end{array}$$

Points are then said to be upon the North American datum when they are connected with the station Meades Ranch by a continuous triangulation, through which the corresponding latitudes, longitudes, and azimuths have been computed on the Clarke spheroid of 1866, as expressed in meters, starting from the above data.

USE OF HORIZONTAL CONTROL DATA.

The plan or map for any extensive engineering project, whether or not map construction is the primary object, should have all of its parts properly correlated and should be on the same datum as adjacent surveys. Federal and State mapping organizations have long been aware of the necessity for having all surveys based upon a common datum, but the local engineers and surveyors in this country have too often in the past been content, and in many cases compelled, to use a local datum for their surveys. The future economic disadvantage of such a system is now becoming recognized, with the result that city and county surveys are being more generally placed upon a permanent basis by connecting them to stations on the North American datum.

One other factor must be taken into consideration by the engineer of to-day. As the States develop industrially they will undoubtedly follow the lead of one of the Eastern States, Massachusetts, which with splendid foresight has extended its triangulation control over the entire State for the purpose of defining property boundaries in terms of latitude and longitude. The advantage of such a system is well stated in the following extracts from the Report on the Maryland Oyster Survey:

The difficulties of accurately locating and permanently defining the boundaries of a farmer's plantation on land, even with the aid of monuments, public

roads, streams of water, and other points of reference are often great, judging from the disputes frequently arising in connection with boundaries. * *

There is only one point on the earth's surface at the intersection of any parallel of latitude and any one meridian of longitude, and therefore there be no dispute as to the meaning of such a geographic definition of the location of a point, even though all the original triangulation station marks used in determination, together with the chart on which its position was originally plotted, have been totally destroyed.

In the case of the destruction of an original triangulation station mark any other point defined by a geographic position, a competent geodetic engineer can reestablish its exact location by means of a new system of triangulation connecting with other distant triangulation marks which have not been destroyed.

In a section of the country covered by adequate geodetic control the data are available to the engineer for any of the following operations, in addition to its possible future use as a basis for cadastral surveys:

(1) **Extensive mapping.**—The topographer needs as initial data for beginning a topographic survey the distance and direction between two points and the geographic position of one of them, latitude and longitude, on the North American datum. His local triangulation, based on this control, will prevent the accumulation of excessive errors as he carries on his mapping operations. In the event that the available precise triangulation in that region has lines of too great length to join to conveniently he can measure a base and azimuth at some place visible from a precise or a primary triangulation station and connect his base to the station by triangulation, thus obtaining proper geographic positions for his local survey.

Instructions for secondary (formerly called tertiary) triangulation suitable for the control of local surveys, may be found in U. S. Coast and Geodetic Survey Special Publication No. 26, which can be had at a nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C.

(2) **Boundary lines.**—If it is desired to locate or to delineate accurately and permanently the boundaries of political subdivisions such as States, counties, or cities, the methods indicated in the preceding paragraph may be followed. Whenever possible, a line of the adjusted triangulation should be used as a basis for local surveys rather than a point, since a line gives the three essentials—position, length, and direction.

(3) **Local intensive surveys.**—The necessity for such surveys arises most frequently in connection with extensive improvements over a considerable area, or as a basis for city planning, where the needs of a city are being anticipated for a number of years. Here the requirements are somewhat different from those in the preceding operations, for it is often necessary to extend precise primary control in considerable detail over the entire area affected; secondary triangulation or traverse then being used to furnish additional points for the survey. In such a control survey the triangulation should invariably be started from a line of adjusted triangulation on the North American datum.

While it may be noted in the preceding paragraphs that the azimuth and length of one line and the geographic position of one end of that line constitute the essential data for the complete utilization of old work as a basis for new work, there is always grave danger in depending upon this minimum of data. There may be failure

identify the true station mark, or the mark, though genuine, may have been tampered with or otherwise disturbed in position. This will, of course, introduce an error into the new work based on these stations. It is the present practice in this Survey, unless unusual conditions render it unnecessary, to establish the integrity of the recovered points by using at least three old stations as a basis for new work, the third station serving as a check for the two stations on which the new work may actually depend.

In local surveys where the area is of limited extent it is usually desirable to use a system of plane coordinates, the origin being connected to some point of the precise or primary triangulation scheme. Tables for computing plane coordinates from geographic positions are found in U. S. Coast and Geodetic Survey Special Publication No. 71.

The U. S. Coast and Geodetic Survey will be glad to give advice on any problem arising out of the use of its control points or on any proposed extension of triangulation from them.

EXPLANATION OF TABLES.

ARRANGEMENT OF TABULATED DATA.

In the tables of positions the latitude and longitude of each point are given on the North American datum (see p. 2); also the length and azimuth of each line observed over, whether in one way or both ways, to other points of the triangulation. **NO LENGTHS OR AZIMUTHS ARE REPEATED, AND FOR A GIVEN LINE THE LENGTH AND AZIMUTH WILL BE FOUND OPPOSITE THE POSITION OF ONE OR THE OTHER OF THE TWO STATIONS INVOLVED.**

The distances between stations are given in both meters and feet. To facilitate further the use of the tables, a column is given of the logarithms of the lengths in meters. It must be remembered that it is the logarithm of the length in meters which is derived first in the computation, the lengths in meters given in this table being derived from the corresponding logarithm and the lengths in feet in turn derived from the lengths in meters by the aid of the conversion tables on pages 37-44. Where further work of considerable extent is contemplated, an accumulation of error in the last two operations can be avoided by using the logarithm.

EXPLANATION OF LENGTHS.

The lengths as given in the tables are all reduced to sea level. If the actual length of a line simply reduced to the horizontal is desired—that is, its length in its actual elevation on the surface of the earth—it may be obtained by adding to the sea level length as given in meters a correction = (length of line as given in meters) times

$$\left[\frac{\text{mean elevation of the two ends of the line in meters}}{6\,370\,000} \right].$$

The maximum value of this correction does not exceed $\frac{1}{2000}$ of the length of any line of the triangulation here published. The error introduced by the use of the above approximate formula does not exceed $\frac{1}{1000000}$ of the length of any portion of this triangulation.

AZIMUTH AND BACK AZIMUTH.

Because of the convergence of the meridians the azimuth and back azimuth of a line do not differ by exactly 180° , the amount of the divergence varying with the latitude and the difference of longitude of the two points. To illustrate from the tables, page 10, the azimuth from Mears to Bally is $16^\circ 28' 16.''81$, while the back azimuth, or the azimuth from Bally to Mears is $196^\circ 20' 20.''42$.

The azimuths of the triangulation lines offer a very convenient and accurate means of testing the error of the magnetic needle on a surveyor's transit, and even the azimuth over such short distances as those between a station mark and its reference mark may be used for this purpose with fair accuracy, provided the distance is greater than 100 feet.

ACCURACY OF DATA INDICATED IN TABLES.

The rule followed in recent publications of this office has been to give latitudes and longitudes to thousandths of seconds for all points, the positions of which are fixed by fully adjusted triangulations. Points, the positions of which are given to hundredths of seconds only, are marked by footnotes as being without check (observed from only two stations) or checked by vertical angles only.

In the columns giving azimuths, distances, and logarithms of distances, the accuracy is indicated to a certain extent by the number of decimal places given, it being understood that in each case two doubtful figures are given. In some cases there is very little doubt of the correctness of the second figure from the right, while in a few cases some doubt may be cast on the third figure from the right.

HOW TO FIND THE DATA DESIRED.

Following the index at the back of this publication are seven maps. The first is an index map showing all areas in the United States covered by published triangulation rigidly computed on the North American datum. Following that is an index map showing the boundaries of each of the triangulation sketches. (Figs. 3 to 7.) The other five are detailed maps showing the scheme of triangulation plotted by latitudes and longitudes on a polyconic projection.

Having found from these sketches the names of the points desired, the tables may then be conveniently consulted by using the index at the end of this publication. In the appropriately headed columns opposite the name of each station are given the pages on which may be found its geographic position, description, and elevation above sea level, and the number of the detailed sketch showing the scheme of observed lines from that station.

RELATED PUBLICATIONS.

Engineers and other using the data given in this report for the control of maps and surveys will find it of help to have Special Publications Nos. 5, 8, and 71 of the U. S. Coast and Geodetic Survey. They may be obtained at a nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Special Publication No. 5 is entitled "Tables for a polyconic projection of maps based on Clarke's reference spheroid of 1866." This publication contains the necessary explanation of the method employed in constructing a polyconic projection, and also gives the values in meters of the degrees, minutes, and seconds of latitude and longitude for all latitudes.

Special Publication No. 8 is entitled "Formulæ and tables for the computation of geodetic positions." As the title of this publication implies, the data contained in it will enable one to compute the spherical coordinates for triangulation where the distances and angles are known.

Special Publication No. 71 is entitled "Relation between plane rectangular coordinates and geographic positions." This book contains tables which will facilitate the use by engineers of plane coordinates for local surveys.

The principal lists of geographic positions published on the North American datum throughout the United States, together with descriptions of stations, are contained in the following publications of the U. S. Coast and Geodetic Survey and of other organizations:

Appendix 8 of the Report for 1888., positions in Connecticut.

Appendix 8 of the Report for 1893, positions in Pennsylvania, Delaware, and Maryland.

Appendix 6 of the Report for 1901, positions and descriptions in Kansas and Nebraska.

Appendix 4 of the Report for 1903, positions and descriptions in Kansas, Oklahoma, and Texas.

Appendix 9 of the Report for 1904, positions and descriptions in California.

Appendix 5 of the Report for 1905, positions and descriptions in Texas.

Appendix 3 of the Report for 1907, positions and descriptions in California.

Appendix 5 of the Report for 1910, positions and descriptions in California.

Appendix 4 of the Report for 1911, positions and descriptions in Nebraska, Minnesota, North Dakota, and South Dakota.

Appendix 5 of the Report for 1911, positions and descriptions in Texas.

Appendix 6 of the Report for 1911, positions and descriptions in Florida.

Special Publication No. 11, positions and descriptions in Texas, New Mexico, Arizona, and California.

Special Publication No. 13, positions and descriptions in California, Oregon, and Washington.

Special Publication No. 16, positions and descriptions in Florida.

Special Publication No. 17, positions and descriptions in Texas.

Special Publication No. 19, positions and descriptions in Colorado, Utah, Nevada, Wyoming, Montana, South Dakota, and North Dakota.

Special Publication No. 24, positions and descriptions in Alabama and Mississippi.

Special Publication No. 30, positions and descriptions in West Virginia, Ohio, Kentucky, Indiana, Illinois, and Missouri.

Special Publication No. 31, positions and descriptions in Oregon, Washington, and California.

Special Publication No. 43, positions in Georgia.

Special Publication No. 45, descriptions in Georgia.

Special Publication No. 46, positions and descriptions in Maine.

Special Publication No. 54, positions and descriptions in Texas.

Special Publication No. 62, positions and descriptions in Rhode Island.

Special Publication No. 70, positions and descriptions in Kansas.

Special Publication No. 74, positions and descriptions in Idaho, Oregon, and Washington.

Special Publication No. 76, positions and descriptions in Massachusetts.

Special Publication No. 78, positions and descriptions in Texas (Rio Grande arc).

Special Publication No. 79, positions and descriptions in Indiana.

Report on triangulation of Greater New York.

Progress report on a plan of sewerage for the city of Cincinnati.

Appendix EEE, pages 2905-3031, Annual Report of the Chief of Engineers, U. S. Army, 1902, positions of points on and near the Great Lakes.

Professional Paper No. 24, Corps of Engineers, U. S. Army, descriptions of points on and near the Great Lakes.

Publications of the Massachusetts Commission on Waterways and Public Lands.

Various bulletins of the United States Geological Survey.

Geographic positions.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
<i>Principal points.</i>							
Mount Helena, 1876..	38 40 11.080	245 56 18.019	67 22 03.416	Mount Lola.....	5.33015644	213873.23	701682.4
	122 37 57.817	324 01 34.823	144 28 18.913	Mount Diablo.....	5.03233246	107728.96	353440.8
		269 20 15.615	90 58 57.203	Round Top.....	5.3600267	229100.84	751641.7
Marysville Butte, 1876.	39 12 22.361	50 03 28.78	229 32 49.63	Mount Helena	4.9650596	92269.81	302721.9
	121 49 11.540	103 30 30.51	282 54 51.87	Snow Mountain west.	4.9197549	83129.44	272733.8
Snow Mountain west, 1892.	39 22 38.452	352 06 02.01	172 10 45.86	Mount Helena	4.8992657	79298.64	260165.6
	122 45 28.619	18 03 03.98	197 49 26.49	Ross Mountain.	5.0073412	101704.73	333876.3
Snow Mountain east, 1876.	39 23 02.008	283 29 49.08	104 05 12.82	Marysville Butte.	4.9177231	82741.44	271460.9
	122 45 04.847			Mount Helena	4.9027792	79942.78	262278.9
		352 34 48.70	172 39 17.60	Snow Mountain west.	2.9650893	922.76	3027.4
Kent, 1904.....	39 58 01.752	316 41 36.16	137 16 41.00	Marysville Butte.	5.0627330	115540.16	379068.0
	122 44 14.449			Snow Mountain east.	4.8113645	64768.60	212495.0
		1 04 01.62	181 03 29.44				
Lyons, 1904.....	40 18 06.101	7 18 50.85	187 11 54.82	Marysville Butte.	5.0885296	122611.05	402266.4
	121 38 21.007			Snow Mountain east.	5.1444074	139446.43	457500.5
		43 24 27.26	222 41 41.92	Kent.....	5.0030155	100696.76	330369.3
Bally, 1904.....	40 36 11.939	291 00 16.70	111 39 38.03	Lyons.....	4.9640996	92064.79	302049.2
	122 39 00.370	6 01 26.68	185 58 03.60	Kent.....	4.8514233	71026.97	233027.6
Round, 1904.....	40 48 19.882	334 10 02.02	154 22 27.03	Lyons.....	4.7931190	62103.91	203752.6
	121 57 26.873	35 40 46.89	215 10 27.70	Kent.....	5.0578276	114242.48	374810.5
		69 14 22.18	248 47 16.01	Bally.....	4.7972334	62695.07	205692.1
Spur, 1904.....	41 24 14.648	339 42 45.15	159 54 13.91	Round.....	4.8501774	70823.50	232360.1
	122 14 54.491	20 56 17.28	200 40 28.60	Bally.....	4.9783111	95128.60	312101.1
Mears, 1904.....	41 07 29.538	208 15 08.51	28 23 01.90	Spur.....	4.5468137	35221.98	115557.4
	122 26 52.260	310 30 15.44	130 49 32.84	Round.....	4.7357813	54422.85	178552.3
		16 28 16.81	196 20 20.42	Bally.....	4.7808671	60376.39	198094.9
Boliver (Calif.), 1904.	41 15 35.575	250 01 14.88	70 22 17.82	Spur.....	4.6745307	47264.02	155065.4
	122 46 46.811	298 11 54.84	118 25 01.56	Mears.....	4.4999381	31618.27	103734.3
		351 26 43.00	171 31 48.60	Bally.....	4.8676103	73724.24	241876.9
Soda (Oreg.), 1904...	42 03 54.670	345 19 52.95	165 29 03.58	Spur.....	4.8801006	75875.33	248934.3
	122 28 41.648	15 46 47.39	195 34 46.02	Boliver.....	4.9680058	92897.87	304782.4
Gazelle astronomic station, 1904.	41 31 36.248	183 13 35.19	3 15 12.92	Soda.....	4.7774266	59900.25	196522.7
	122 31 08.281	300 59 40.18	121 10 24.99	Spur.....	4.4213899	26386.99	86571.3
Sterling (Oreg.), 1904.	42 01 03.864	261 00 09.26	81 16 33.53	Soda.....	4.5341916	34213.03	112247.2
	122 53 11.434	321 51 54.19	142 17 22.56	Spur.....	4.9385271	86401.66	283469.4
		353 55 38.45	173 59 54.01	Boliver.....	4.9275789	84040.63	277691.8
Rust, 1904.....	42 37 10.930	9 58 58.92	189 53 41.33	Soda.....	4.7961114	62533.30	205161.3
	122 20 50.147	33 47 58.14	213 26 11.14	Sterling.....	4.9046802	80293.46	263429.5
Onion, 1904.....	42 41 31.762	276 02 52.70	96 38 45.29	Rust.....	4.8621488	72802.92	238854.2
	123 13 46.921	318 07 09.53	138 37 33.00	Soda.....	4.9692721	93169.15	305672.4
		339 12 19.09	159 26 11.48	Sterling.....	4.9034795	80071.78	262702.2
Black, 1904.....	43 09 37.503	350 59 07.43	171 03 51.98	Rust.....	4.7839902	60812.13	199514.5
	122 27 48.236	50 31 05.83	229 59 46.98	Onion.....	4.9104227	81362.20	266935.8

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
Principal points—Continued.							
White, 1904.....	43 07 14.428	264 24 10.96	84 47 44.04	Black.....	4.6712655	46910.01	153903.9
	123 02 14.761	314 23 02.31	134 51 12.74	Rust.....	4.8989012	79232.11	259947.3
		18 19 13.10	198 11 21.87	Onion.....	4.7000681	50126.59	164457.0
Scott, 1904.....	43 22 21.758	295 36 15.65	116 00 57.67	Black.....	4.7337520	54169.15	177720.0
	123 03 05.517	355 34 45.07	175 35 50.67	White.....	4.4484509	28083.48	92137.2
Fairview, 1904.....	43 35 10.459	341 59 37.72	162 07 24.98	Black.....	4.6965851	49726.19	163143.3
	122 39 08.622	31 14 40.80	210 58 49.21	White.....	4.7811331	60413.38	198206.2
		54 40 43.54	234 23 43.86	Scott.....	4.6116108	40889.41	134151.3
Yellow, 1904.....	43 32 48.849	265 37 03.17	86 08 04.66	Fairview.....	4.7836960	60770.94	199379.3
	123 24 09.568	305 06 41.39	125 20 39.92	Scott.....	4.5256936	33550.08	110072.2
		327 50 53.15	148 05 55.44	White.....	4.7470519	55853.69	183246.6
Spencer, 1903.....	43 59 00.715	320 57 05.87	141 15 27.90	Fairview.....	4.7537056	56716.00	186075.7
	123 05 41.248	27 10 28.02	206 57 41.38	Yellow.....	4.7362330	54479.49	178738.1
Roman, 1903.....	43 54 45.041	261 04 53.49	81 31 39.25	Spencer.....	4.7176307	52195.22	171243.8
	123 44 14.987	292 09 05.10	112 54 06.43	Fairview.....	4.9759767	90418.63	310428.0
		326 17 38.82	146 31 32.08	Yellow.....	4.6880983	48763.89	159986.2
Mary, 1903.....	44 30 17.369	327 37 54.62	147 57 02.02	Spencer.....	4.8354276	68458.53	224601.0
	123 33 05.732	12 47 13.03	192 39 26.37	Roman.....	4.8291199	67471.43	221362.5
Peterson, 1903.....	44 30 38.293	9 50 19.67	189 45 01.69	Spencer.....	4.7740504	59436.11	195000.0
	122 58 05.537	43 02 28.28	222 30 17.06	Roman.....	4.9568321	90538.25	297040.9
		89 24 24.75	268 59 52.49	Mary.....	4.6664822	46396.18	152218.1
Twin, 1905.....	44 19 31.401	10 57 11.34	190 53 21.59	Spencer.....	4.5875519	38685.83	126921.8
	123 00 11.426	52 17 07.57	231 46 27.22	Roman.....	4.8725285	74563.88	244631.7
		114 43 37.75	294 20 36.03	Mary.....	4.6813809	48015.44	157530.7
Ridge, 1905.....	44 16 02.051	146 33 52.16	326 24 39.71	Peterson.....	4.3174815	20772.15	68150.0
	123 19 55.940	226 52 25.20	47 07 41.87	Mary.....	4.5005667	31664.07	103884.5
		256 03 38.80	76 17 26.03	Twin.....	4.5983320	39658.11	130111.6
Rauch, 1903.....	44 00 50.965	328 50 07.61	149 00 02.67	Spencer.....	4.4320513	27042.78	88722.9
	123 19 42.158	179 22 37.92	359 22 28.32	Spencer.....	4.5659404	36807.85	120760.4
		207 24 34.93	27 39 39.91	Ridge.....	4.4490510	28122.31	92264.6
Willamette south base, 1903.....	44 04 06.905	216 50 01.62	37 03 37.36	Peterson.....	4.7938886	62214.07	204114.0
	123 11 17.933	280 12 45.16	100 22 29.29	Twin.....	4.6362034	43271.64	141967.0
				Spencer.....	4.2797227	19042.44	62475.1
Willamette north base, 1905.....	44 04 06.905	61 44 15.53	241 38 25.01	Rauch.....	4.1055673	12751.68	41836.1
	123 11 17.933	149 14 18.50	328 59 05.33	Mary.....	4.7519303	56484.64	185316.7
		152 30 46.78	332 24 45.86	Ridge.....	4.3960802	24893.17	81670.3
Seavies 2, 1908.....	44 06 24.663	199 36 13.85	19 45 27.19	Peterson.....	4.7173937	52166.74	171150.4
	123 00 09.593	207 21 02.47	27 28 47.11	Twin.....	4.5071120	32144.90	105462.1
		321 32 17.88	141 36 11.87	Spencer.....	4.0814772	12063.61	39578.7
Pisgah, 1908.....	44 00 19.836	25 09 09.08	205 04 16.61	Rauch.....	4.3428910	22023.74	72256.2
	122 57 51.568	130 22 30.94	310 17 28.19	Ridge.....	4.1016178	12636.24	41457.4
		228 35 55.72	48 44 39.50	Twin.....	4.3457607	22169.74	72735.2
Eugene astronomic station, 1894.....	44 03 30.319	338 06 50.53	158 11 43.21	Spencer.....	4.4005529	25150.86	82515.8
	123 05 28.438	352 20 18.07	172 21 16.55	Willamette south base.....	4.1487287	14019.38	45995.2
		1 57 54.04	181 57 45.14				
Yam, 1903.....	45 03 44.993	347 14 12.38	167 21 35.33	Peterson.....	4.7984079	62864.86	206249.1
	123 08 34.292	27 42 30.71	207 25 14.16	Mary.....	4.8445219	69907.19	229353.8

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
<i>Principal points—Continued.</i>							
Hult, 1903.....	44 57 48.151	22 00 26.69	201 49 39.13	Peterson.....	4.7342429	54230.41	177920.9
	122 42 45.524	52 48 55.91	232 13 30.19	Mary.....	4.9229453	83742.39	274744.8
		108 08 46.40	287 50 31.00	Yam.....	4.5521619	35668.40	116989.3
Barnes (Oreg.), 1903.	45 31 36.526	357 18 16.35	177 19 51.87	Hult.....	4.7971754	62686.70	205664.6
	122 45 00.031	30 59 06.87	210 42 21.69	Yam.....	4.7789013	60108.71	197190.3
Larch (Oreg.), 1903..	45 31 59.615	38 01 16.39	217 34 36.71	Hult.....	4.9038918	80147.83	262951.7
	122 05 13.018	58 05 53.27	237 20 51.35	Yam.....	4.9910591	97962.33	321398.1
		89 26 53.40	268 58 29.97	Barnes.....	4.7143480	51902.18	169954.3
Star (Wash.), 1906...	45 44 47.711	333 33 31.93	153 40 00.32	Larch.....	4.4227804	26471.61	86848.9
	122 14 16.246	58 43 49.19	238 21 51.02	Barnes.....	4.6703557	46811.84	153581.8
Davis (Wash.), 1906.	45 59 37.452	314 32 26.39	134 47 51.18	Star.....	4.5918990	39075.00	128198.6
	122 35 44.667	13 04 37.13	192 57 59.25	Barnes.....	4.7264533	53266.40	174758.2
Red (Wash.), 1906...	45 56 07.249	25 01 17.31	204 49 49.37	Larch.....	4.6927096	49284.42	161694.0
	121 49 12.344	57 16 07.55	236 58 08.64	Star.....	4.5870908	38644.78	126787.1
		96 26 22.46	275 52 55.02	Davis.....	4.7815631	60473.22	198402.6
Warren (Oreg.), 1903	45 48 33.229	225 52 07.84	46 03 54.50	Davis.....	4.4698843	29504.23	96798.5
	122 52 08.679	296 26 15.40	116 59 49.58	Larch.....	4.9339771	68230.27	223852.1
		343 29 22.08	163 34 28.69	Barnes.....	4.5149689	32731.73	107387.3
Lam, 1906.....	46 07 57.903	293 35 59.64	114 03 42.24	Red.....	4.7348430	54305.40	178167.0
	122 27 42.295	33 54 34.32	213 48 46.96	Davis.....	4.2699939	18607.75	61048.9
Len, 1906.....	46 18 45.173	329 52 16.76	150 05 49.99	Red.....	4.6850313	48420.72	158890.3
	122 08 00.508	45 23 14.48	225 03 14.29	Davis.....	4.7016486	50309.34	165056.6
		51 50 33.78	231 36 20.49	Lam.....	4.5087061	32263.10	105849.9
Toutle, 1905.....	46 17 10.419	264 39 01.27	84 57 07.49	Len.....	4.5090454	32288.32	105932.6
	122 33 02.971	338 01 14.03	158 05 05.52	Lam.....	4.2646430	18392.59	60343.0
		6 00 34.19	186 04 37.60	Davis.....	4.5144954	32696.06	107270.3
Huck, 1905.....	46 42 45.136	332 25 33.37	152 38 39.90	Len.....	4.6999316	50110.83	164405.3
	122 26 04.593	10 42 13.91	190 37 10.43	Toutle.....	4.6832391	48221.32	158206.1
Bel, 1905.....	46 47 04.983	15 52 53.95	195 44 27.47	Len.....	4.7368025	54550.97	178972.6
	121 56 22.841	40 27 22.81	220 00 45.94	Toutle.....	4.8608486	72585.28	238140.2
		78 12 07.24	257 50 29.50	Huck.....	4.5872792	38661.55	126842.1
Hal, 1905.....	46 43 52.344	261 10 35.73	81 33 00.02	Bel.....	4.5978304	39612.33	129961.5
	122 27 08.201	326 55 58.87	146 56 45.18	Huck.....	3.3937882	2476.21	8124.0
Rain, 1905.....	46 50 07.065	275 21 54.89	95 54 33.66	Bel.....	4.7576825	57237.74	187787.5
	122 41 09.422	302 52 33.79	123 02 46.85	Hal.....	4.3277217	21267.75	69775.9
		305 18 57.41	125 29 56.74	Huck.....	4.3720505	23553.23	77274.2
Hurst, 1905.....	47 05 02.549	307 07 42.31	127 32 48.86	Bel.....	4.7392818	54863.28	179997.3
	122 30 44.966	351 47 38.64	171 51 03.36	Huck.....	4.6203825	41723.67	136888.4
		353 18 25.73	173 21 04.03	Hal.....	4.5965035	39491.49	129565.0
		25 35 08.72	205 27 32.32	Rain.....	4.4863335	30643.15	100535.1
Pen, 1905.....	47 02 05.064	20 34 48.68	200 27 33.28	Hal.....	4.5566543	36029.17	118205.7
	122 17 11.732	54 03 04.74	233 45 24.39	Rain.....	4.5755995	37635.66	123476.3
		107 47 37.81	287 37 42.47	Hurst.....	4.2556667	18016.36	59108.6
Tacoma south base, 1905.	47 04 38.837	292 48 20.30	112 54 50.97	Pen.....	4.0872032	12223.72	40104.0
	122 26 05.422	1 59 00.26	181 58 14.43	Hal.....	4.5856276	38514.80	126360.6
		35 28 04.55	215 17 03.88	Rain.....	4.5187312	33016.51	108321.7
		97 06 24.06	277 02 59.34	Hurst.....	3.7739623	5942.41	19496.1
Tacoma north base, 1905.	47 11 09.189	326 29 52.90	146 36 18.63	Pen.....	4.3040283	20138.56	66071.3
	122 25 58.206	0 43 24.61	180 43 19.32	Tacoma south base.....	4.0811877	12055.570	39552.32
		1 41 03.08	181 40 11.93	Hal.....	4.7038770	50568.14	165905.6
		26 22 29.54	206 11 23.00	Rain.....	4.6381786	43468.90	142614.2
		28 07 11.39	208 03 41.21	Hurst.....	4.1083677	12834.17	42106.8

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
<i>Principal points—Continued.</i>							
Burn, 1905.....	47 13 50.673	316 25 07.53	136 27 52.88	Tacoma north base.	3.8376905	6881.62	22577.4
	122 29 43.535	223 54 05.60	144 03 16.62	Pen.....	4.4304238	26941.63	88391.0
		344 53 16.94	164 55 56.86	Tacoma south base.	4.2467477	17650.12	57907.1
		4 32 34.29	184 31 49.25	Hurst.....	4.2137976	16360.54	53676.2
Kin, 1905.....	47 14 02.319	13 30 16.14	193 29 31.38	Tacoma north base.	3.7402404	5498.45	18039.5
	122 24 57.219	86 36 43.07	266 33 12.88	Burn.....	3.7806720	6033.54	19795.0
Wash, 1905.....	47 16 14.398	308 06 03.35	128 09 04.85	Kin.....	3.8190767	6606.58	21675.1
	122 29 04.374	337 25 01.77	157 27 18.42	Tacoma north base.	4.0088899	10206.74	33486.6
		10 30 52.80	190 30 24.04	Burn.....	3.6546858	4514.25	14810.5
Bos, 1905.....	47 15 59.493	33 54 32.01	213 53 07.11	Kin.....	3.6394393	4359.53	14302.9
	122 23 01.599	93 29 27.78	273 25 01.31	Wash.....	3.8830651	7639.85	25065.1
Gull, 1891.....	47 17 52.574	313 53 29.85	133 55 36.67	Bos.....	3.7020410	5035.48	16520.6
	122 25 54.219	350 25 44.00	170 26 25.88	Kin.....	3.8579978	7211.04	23658.2
		52 49 52.33	232 47 32.62	Wash.....	3.7003670	5016.11	16457.0
Dron, 1905.....	47 18 00.812	310 43 39.16	130 46 11.18	Bos.....	3.7588960	5739.79	18831.3
	122 26 28.511	345 23 09.48	165 24 16.54	Kin.....	3.8814482	7611.11	24670.8
		44 55 13.27	224 53 18.75	Wash.....	3.6665016	4639.82	15222.5
Smelt, 1905.....	47 17 46.283	265 53 53.35	85 57 33.87	Dron.....	3.8007266	6320.14	20735.3
	122 31 28.575	313 06 11.23	133 07 57.18	Wash.....	3.6182138	4151.58	13620.6
Neill 2, 1905.....	47 19 55.014	312 55 19.83	132 57 32.48	Dron.....	3.7140633	5177.06	16985.1
	122 29 28.963	355 39 41.56	175 39 59.63	Wash.....	3.8345920	6832.69	22416.9
		32 18 07.50	212 16 39.57	Smelt.....	3.6723549	4702.78	15429.0
Tacoma astronomic station, 1892.	47 15 47.911	156 34 15.80	336 32 20.05	Neill 2.....	3.9200079	8317.79	27289.3
	122 26 51.446	197 20 35.49	17 21 17.53	Gull.....	3.6056668	4033.36	13232.8
<i>Supplementary points.</i>							
Mount St. John, 1904 ¹	39 26 03.17	176 16 31	356 14 48	Kent.....	4.773030	59296.6	194542
	122 41 32.14	288 19 10	108 52 20	Marysville Butte.	4.899689	79376.0	260419
Corning tower, 1904.....	39 55 40.774	95 23 05.04	275 01 34.16	Kent.....	4.6805528	47923.97	157230.6
	122 10 44.008	227 46 57.18	48 07 49.11	Lyons.....	4.7921037	61958.90	203276.8
		338 49 44.76	159 03 28.06	Marysville Butte.	4.9338347	85968.67	281720.8
Corning astronomic station, 1908.	39 55 40.48	247 24 10	67 24 11	Corning tower.	1.36933	23.41	76.8
Mount Linn, top of peak, 1904.	40 02 12.617	195 17 14.5	15 25 07.8	Bally.....	4.814440	65228.9	214005
	122 51 11.855	263 44 09.8	74 31 09.3	Lyons.....	5.031505	107523.9	352768
		315 46 22.4	136 25 54.9	Marysville Butte.	5.107132	127977.0	419871
Lassen Peak, 1904.....	40 29 18.614	10 50 33.3	190 38 25.4	Marysville Butte.	5.161103	144911.5	475430
	121 30 15.513	28 56 28.7	208 51 14.1	Lyons.....	4.374630	23693.5	77734
		61 31 03.3	240 43 16.5	Kent.....	5.078644	119851.7	393213
Bully Choop, 1904.....	40 33 20.346	241 41 39.9	61 46 12.1	Bally.....	4.048286	11176.0	36667
	122 45 58.884	296 03 36.6	106 47 28.1	Lyons.....	4.998792	99722.2	327172
		357 49 40.2	177 50 47.7	Kent.....	4.815526	65392.2	214541
Redding courthouse, 1908.	40 34 58.278	96 06 13.3	275 56 17.2	Bally.....	4.335680	21661.1	71066
	122 23 44.281	236 07 45.1	56 24 53.6	Round.....	4.648670	44531.8	146101
Redding astronomic station, 1904.	40 34 19.354	99 11 08.7	279 01 09.1	Bally.....	4.341461	21951.3	72019
	122 23 38.684	173 44 41.4	353 44 37.8	Redding courthouse.	3.082013	1207.8	3963
		234 46 13.9	55 03 18.7	Round.....	4.654218	45104.3	147980

¹ Checked by vertical angles only.

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
<i>Supplementary points—Continued.</i>							
Redding south base, 1908.	40 34 28.152	50 02 58.9	230 02 49.9	Redding as- tronomical sta- tion.	2.625930	422.6	1386
	122 23 24.911	91 29 00.2	271 28 50.5	Hill.....	2.545762	351.4	1153
		153 53 14.2	333 53 01.6	Redding court- house.	3.014915	1034.9	3395
Redding north base, 1908.	40 34 42.167	352 28 22.7	172 28 24.2	Redding south base.	2.639542	436.1	1431
	122 23 27.340	20 46 04.0	200 45 56.6	Redding as- tronomical sta- tion.	2.876541	752.6	2469
		34 47 58.0	214 47 49.9	Hill.....	2.712126	515.4	1691
		141 17 01.8	321 16 50.8	Redding court- house.	2.804122	637.0	2090
Hill, 1908.....	40 34 28.446	354 26 27.4	174 26 28.2	Redding as- tronomical sta- tion.	2.440913	281.8	925
	122 23 39.845	173 31 58.0	353 31 55.1	Redding court- house.	2.966656	926.1	3038
Crater Peak, 1904....	40 41 54.374	2 19 29.9	182 18 40.7	Lyons.....	4.644353	44091.3	144656
	121 37 05.274	83 26 10.3	262 45 50.1	Bally.....	4.944089	87920.3	288452
		124 23 11.6	303 50 35.4	Mears.....	4.926513	84433.2	277011
Thompson Peak, 1904. ¹	40 56 37.67	225 27 58	45 52 36	Spur.....	4.864213	73149.8	239992
	122 52 19.33	240 26 59	60 43 42	Mears.....	4.612243	40949.0	134347
Saw Tooth, 1904.....	40 58 21.995	232 35 06.1	53 04 51.4	Spur.....	4.899168	79280.8	26010.
	123 00 05.396	249 52 27.8	70 14 16.7	Mears.....	4.694762	49517.9	162460
		324 01 15.2	144 15 01.6	Bally.....	4.704374	50626.0	166095
Mount Eddy, cairn, 1904.	41 19 12.449	75 14 54.3	255 02 58.9	Boliver.....	4.416695	26103.3	85641
	122 28 42.470	180 00 47.0	0 00 47.6	Soda.....	4.917772	82750.8	271492
		244 04 37.5	64 13 44.6	Spur.....	4.330090	21384.1	70158
Black Butte, cairn, 1904.	41 22 00.307	148 20 23.9	327 58 52.5	Sterling.....	4.929970	85107.9	279225
	122 20 49.936	141 07 26.9	321 00 37.6	Gazelle astro- nomical sta- tion.	4.358721	22841.3	74938
		243 19 08.0	63 23 03.0	Spur.....	3.965684	9240.3	30316
		172 02 30.6	351 57 16.6	Soda.....	4.893957	78335.2	257005
Mount Shasta, top, 1904.	41 24 33.797	343 25 01.5	163 34 21.4	Round.....	4.844749	69943.8	229474
	122 11 38.482	23 21 05.6	203 03 08.3	Bally.....	4.988525	97392.4	319528
		34 01 48.5	213 51 45.8	Mears.....	4.580807	38089.6	124966
		71 28 59.0	251 05 46.5	Boliver.....	4.713995	51760.1	169816
		139 46 03.1	319 18 24.3	Sterling.....	4.948444	88806.4	291359
		162 06 35.9	341 55 14.8	Soda.....	4.884108	76578.7	251242
China Mountain, not the cairn, 1904.	41 22 41.420	4 12 29.0	184 09 32.3	Bally.....	4.935906	86279.2	283068
	122 34 31.102	52 33 09.7	232 25 03.9	Boliver.....	4.333907	21572.8	70777
		186 00 38.1	6 04 30.6	Soda.....	4.884968	76730.5	251740
		263 53 09.2	84 06 07.2	Spur.....	4.439125	27486.9	90180
Russian Peak, north point, 1904.	41 16 59.106	183 44 19.2	3 46 53.2	Sterling.....	4.912596	81770.4	268275
	122 57 03.164	256 53 40.8	77 21 31.2	Spur.....	4.780366	60306.8	197857
		280 07 36.0	100 14 22.5	Boliver.....	4.163622	14575.5	47820
Russian Peak, south point, 1904. ²	41 16 58.70	256 53 00	77 20 51	Spur.....	4.780398	60311.2	197871
	122 57 03.24	292 25 38	112 45 31	Mears.....	4.659934	45701.9	149940
Marble Mountain, 1904.	41 34 46.625	199 11 35.3	19 19 46.2	Sterling.....	4.712199	51546.5	169115
	123 05 27.947	223 09 00.2	43 33 31.4	Soda.....	4.870229	74170.1	243340
		285 12 26.0	105 45 55.8	Spur.....	4.863427	73017.5	239558
Little Shasta, 1904....	41 43 14.240	42 30 04.4	222 07 53.9	Boliver.....	4.840115	69201.4	227038
	122 13 18.490	121 06 02.3	300 39 25.2	Sterling.....	4.808209	64299.7	210957
		151 00 27.3	330 50 10.8	Soda.....	4.641374	43789.9	143667

¹ Checked by vertical angles only.² No check on this position.

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
<i>Supplementary points—Continued.</i>							
Goose Nest, tall tree (Cal.), 1904.	41 48 58.928	36 08 58.7	215 52 42.6	Gazelle astronomic station.	4.599314	39747.9	130406
	122 14 19.005			Boliver.....	4.893890	76540.3	251116
		26 19 45.5	215 58 13.8	Soda.....	4.531977	34039.0	111678
		144 21 42.8	324 12 06.2	Sterling.....	4.765054	58217.6	191002
Preston Peak (Cal.), 1904.	41 50 07.93	198 10 15	18 25 38	Onion.....	5.000947	100218.3	328900
	123 36 39.82	251 06 55	71 37 58	Sterling.....	4.802197	63415.7	208956
Greyback (Oreg.), 1904.	42 06 37.101	185 55 39.3	5 58 58.1	Onion.....	4.812795	64982.4	213196
	123 18 41.721	210 31 32.8	31 06 01.1	Black.....	5.132966	135820.7	445605
		286 08 49.7	106 25 54.9	Sterling.....	4.564137	36655.3	120260
Pilot Rock, 1904.....	42 01 51.653	12 08 01.3	191 59 15.8	Boliver.....	4.942399	87578.8	287331
	122 33 36.073	86 59 17.2	266 46 10.4	Sterling.....	4.432656	27080.5	88847
		240 41 59.1	60 45 16.4	Soda.....	3.899986	7762.2	25466
		339 28 26.6	139 40 33.0	Spur.....	4.871003	74302.4	243774
Siskiyou, 1904 ¹	42 03 44.11	151 24 26	331 05 35	Onion.....	4.902040	79960.8	261833
	122 45 49.09	269 06 50	89 18 18	Soda.....	4.378372	23625.0	77510
Kerby, 1904 ¹	42 13 14.81	199 49 51	19 59 12	Onion.....	4.745767	55688.7	182705
	123 27 35.84	243 48 38	64 33 41	Rust.....	5.007567	101757.6	333850
Ashland Peak, cairn, 1904	42 04 52.547	148 14 12.4	327 53 25.9	Onion.....	4.902873	79960.0	262335
	122 42 57.867	206 48 39.6	27 03 34.1	Rust.....	4.826635	67066.5	220100
		275 06 14.9	95 15 47.7	Soda.....	4.265673	19763.9	64842
		332 29 50.9	152 43 31.8	Spur.....	4.927763	84676.5	277809
		8 20 37.4	183 18 05.3	Boliver.....	4.960854	91380.6	299805
Wagner, 1904.....	42 07 05.737	149 39 40.8	329 20 13.1	Onion.....	4.969186	72992.2	242756
	122 46 24.287	192 16 58.1	12 29 34.1	Black.....	5.073816	118526.6	388866
		212 04 35.7	32 21 49.6	Rust.....	4.818477	65838.1	216004
		283 28 19.0	103 40 11.4	Soda.....	4.400065	25122.6	82423
Aspen Peak, 1904.....	42 18 57.286	49 23 40.7	229 07 54.2	Soda.....	4.630179	42675.5	140011
	122 05 12.427	114 22 07.9	298 35 47.8	Onion.....	5.012074	102819.1	337332
		147 40 45.0	337 30 11.8	Rust.....	4.601743	39970.8	131138
Mount Pitt, 1904.....	42 26 41.964	17 45 16.0	197 38 35.2	Soda.....	4.646239	44283.2	145296
	122 18 54.365	110 23 28.0	289 46 20.7	Onion.....	4.902873	79960.0	262335
		171 22 17.4	351 16 14.7	Black.....	4.905232	80395.6	263765
		172 15 27.2	352 14 09.0	Rust.....	4.291956	19586.5	64260
Lost Peak, 1904 ¹	42 30 50.92	102 53 37	282 09 35	Onion.....	4.959834	91166.2	299101
	122 06 42.90	125 19 26	305 11 14	Rust.....	4.807793	20313.9	66647
Central Point astronomic station, 1904.	42 23 51.581	242 56 29.8	63 20 31.3	Rust.....	4.7371413	54593.6	179113
	122 56 23.451	313 56 45.8	134 15 22.8	Soda.....	4.7248137	53065.7	174100
Central Point latitude station, 1904.	42 23 51.512	116 41	296 41	Central Point astronomic station.	0.6785	4.77	15.6
Union Peak, 1903....	42 49 53.546	23 30 40.6	203 25 35.9	Rust.....	4.409163	25654.5	84168
	123 13 21.078	79 42 19.8	259 01 18.0	Onion.....	4.923689	83885.9	275216
		157 31 38.4	337 13 58.9	Fairview.....	4.958228	90629.7	297997
Mount Scott, 1904....	42 55 24.019	36 57 11.5	218 43 40.3	Rust.....	4.636586	43304.8	142076
	122 00 55.349	75 54 57.5	255 05 26.9	Onion.....	5.011101	102589.1	336578
		126 57 47.4	305 39 26.7	Black.....	4.653341	45013.3	147681
Liso Rock, 1904.....	43 57 08.096	21 40 13.7	201 33 56.4	Rust.....	4.599165	39734.3	130362
	122 10 08.336	71 56 52.6	251 13 35.6	Onion.....	4.961284	91471.1	300101
		105 05 45.2	284 30 10.1	White.....	4.864805	73249.6	240320
		124 00 04.6	318 47 59.6	Black.....	4.526112	33361.2	109490
		151 00 38.6	330 40 44.3	Fairview.....	4.905616	80652.2	264806
High Rock, 1904.....	43 03 02.950	99 58 29.9	279 35 51.2	White.....	4.659501	45556.3	149791
	122 29 06.670	189 10 33.3	8 11 26.2	Black.....	4.089936	12300.9	40357
		346 48 45.8	166 49 23.7	Rust.....	4.691934	49196.5	161406

¹ No check on this position.

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
<i>Supplementary points—Continued.</i>							
Old Bailey, 1904.....	43 09 19.966 122 13 09.098	58 22 56.4 86 56 58.3 91 38 41.9 143 52 40.2	237 41 39.0 266 23 24.2 271 28 40.6 323 34 49.3	Onion..... White..... Black..... Fairview.....	4.987860 4.824026 4.296188 4.773418	97243.4 66684.7 19969.5 59349.6	319039 218781 65189 194716
Walker Peak, 1904 ¹ ..	43 11 33.68 122 02 18.18	84 18 22 131 31 15	263 55 55 311 05 56	Black..... Fairview.....	4.540968 4.821076	34743.1 66238.1	113996 217300
Dodson (U. S. G. S.), 1904.	43 07 10.136 123 14 35.150	127 39 24.7 207 16 30.9 269 28 35.0	307 36 20.1 27 23 52.6 89 37 01.2	Burg..... Scott..... White.....	3.886832 4.500640 4.223711	7706.1 31669.4 16738.3	25282 103902 54916
Rose, 1904.....	43 14 09.038 123 19 18.555	233 53 46.81 298 51 36.64	54 04 23.33 119 03 17.19	Scott..... White.....	4.4126232 4.4220406	25850.68 26426.56	84841.3 86701.1
Burg, 1904.....	43 09 42.607 123 19 05.198	177 54 02.44 221 16 38.67 281 13 40.24	357 53 53.30 41 27 05.61 101 25 11.18	Rose..... Scott..... White.....	3.9152697 4.4943632 4.3671347	8227.53 31214.99 23288.13	26993.2 102411.2 76404.5
Roseburg latitude station, 1904.	43 12 40.766 123 21 13.849	223 40 38.71 332 08 06.89	43 41 57.67 152 09 34.93	Rose..... Burg.....	3.5759994 3.7936902	3797.08 6218.42	12369.0 20401.6
Quartz, 1904.....	43 09 51.770 122 40 14.598	80 52 53.4 181 48 31.6 271 25 29.2	260 37 50.6 1 49 16.9 91 33 59.7	White..... Fairview..... Black.....	4.490385 4.671093 4.227036	30226.3 46961.4 16966.9	99167 153843 55337
Diamond Peak, 1904.	43 31 16.014 122 08 54.659	32 36 47.1 100 14 59.1 109 18 18.1 124 18 40.2	212 23 49.1 279 54 09.2 288 12 24.7 308 39 24.4	Black..... Fairview..... Roman..... Spencer.....	4.676943 4.616725 5.131066 4.963379	47516.3 41354.7 135233.7 91913.4	155993 135678 443679 301553
Mount Zion, 1903 ¹ ...	43 47 29.576 122 43 24.335	99 42 38.7 125 41 05.6	279 00 29.5 306 25 38.8	Roman..... Spencer.....	4.917188 4.504457	82638.6 39682.3	271123 129349
Russian Church, cross, 1908.	44 03 18.487 123 10 36.088	148 04 20.1 247 32 11.5 287 52 19.2 320 26 05.3	328 03 51.0 67 39 27.3 108 01 19.6 140 29 30.3	Willamette south base. Seavies 2..... Pisgah..... Spencer.....	3.245722 4.178324 4.262746 4.013515	1760.8 15077.3 17965.6 10316.1	5777 49466 58712 33845
Springfield, Methodist Church, 1908.	44 02 53.545 123 01 20.032	39 01 16.7 101 37 24.9	218 58 15.1 281 34 32.2	Spencer..... Eugene astronomic station.	3.969668 3.751653	9266.3 5644.9	30636 18520
Springfield, Christian Church, 1908.	44 02 51.552 123 01 11.024	40 13 27.9 101 49 52.3 191 43 56.5	220 10 10.0 281 46 43.3 11 44 39.2	Spencer..... Eugene astronomic station. Seavies 2.....	3.969699 3.767444 3.827305	9326.1 5853.9 6719.0	30697 19206 22044
Eugene, Deady Hall, west tower, 1908.	44 02 49.475 123 04 32.924	135 34 35.0 221 23 39.0 12 10 13.9	315 33 56.4 41 26 42.1 192 09 26.3	Eugene astronomic station. Seavies 2..... Spencer.....	3.246821 3.947264 3.858909	1765.3 8858.9 7222.7	5792 29068 23666
Eugene, Geary School spire, 1908.	44 03 22.161 123 06 11.803	101 29 14.4 265 22 35.7	281 25 41.5 75 23 05.8	Willamette south base. Eugene astronomic station.	3.842110 2.969639	6652.0 997.6	22806 3273
Eugene, United Brethren Church, 1908.	44 02 53.996 123 05 02.786	105 07 28.9 153 01 50.8	285 03 08.1 333 01 33.1	Willamette south base. Eugene astronomic station. Seavies 2..... Pisgah..... Spencer.....	3.936928 3.100014 3.964328 4.030071	8648.2 1250.0 9211.4 10716.9	28373 4131 30221 35160

¹ No check on this position.

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
Supplementary points—Continued.							
Eugene, Patterson School spire, 1908.	44 02 47.636	9 51 56.2	189 51 20.2	Spencer.....	3.851794	7108.8	23323
	123 04 46.593	144 44 27.6	324 43 58.6	Eugene as- tronomi- c station.	3.207756	1613.5	5294
		222 35 32.0	42 38 44.7	Seavies 2.....	3.969172	9102.7	29864
Eugene, Baptist Church spire, 1908.	44 03 05.830	103 18 42.4	283 14 32.7	Willamette south base.	3.914232	8207.9	26929
	123 05 19.023	164 30 00.1	344 30 02.6	Eugene as- tronomi- c station.	2.894509	784.3	2573
		228 15 28.8	48 19 04.1	Seavies 2.....	3.964873	9223.0	30259
		297 10 01.0	117 15 11.9	Pisgah.....	4.049392	11204.5	36700
Eugene, W. O. W. Hall spire, 1908.	44 03 05.553	207 25 20.7	27 25 42.1	Eugene as- tronomi- c station.	2.935103	861.2	2825
	123 05 46.259			Seavies 2.....	3.986290	9689.2	31789
		230 36 09.7	50 40 03.9	Pisgah.....	4.069796	11743.5	38523
Eugene, courthouse, flagpole, 1908.	44 03 06.273	103 23 55.9	283 19 49.7	Willamette south base.	3.908272	8096.0	26562
	123 06 24.041	172 29 22.8	352 29 19.7	Eugene as- tronomi- c station.	2.874247	748.6	2456
		228 46 41.9	48 50 20.6	Seavies 2.....	3.968374	9297.7	30504
		296 58 08.6	117 03 23.0	Pisgah.....	4.053471	11310.2	37107
Eugene, Methodist Church, 1908.	44 02 56.857	105 41 44.6	285 37 43.6	Willamette south base.	3.903543	8008.4	26274
	123 05 31.498	183 46 22.9	3 46 25.0	Eugene as- tronomi- c station.	3.014948	1035.0	3396
		228 07 33.9	48 11 17.8	Seavies 2.....	3.962833	9614.6	31544
		295 16 37.7	115 21 57.2	Pisgah.....	4.054279	11331.3	37176
Seavies (U. S. G. S.), 1908. ¹	44 06 31.970	29 01 13.7	208 57 12.7	Spencer.....	4.202007	15922.8	52238
	122 59 54.656	73 39 13.6	253 31 18.2	Willamette south base.	4.199633	15946.5	51990
Ball Butte, 1908.....	43 58 47.550	60 56 47.4	240 16 44.4	Fairview.....	4.960000	89125.1	292405
	121 41 15.765	88 06 26.2	266 41 05.0	Roman.....	5.216758	164724.4	540433
		90 41 41.0	269 43 03.5	Spencer.....	5.052670	112993.8	370386
St. Mary Butte, 1903.	44 05 00.402	54 34 20.3	233 54 42.2	Fairview.....	4.975587	94533.8	310150
	121 41 54.992	84 05 04.6	262 40 05.7	Roman.....	5.216529	164637.6	540149
		84 49 15.3	263 51 01.6	Spencer.....	5.051040	112470.9	368998
South Sister, 1903.....	44 06 14.251	51 18 35.7	230 41 52.5	Fairview.....	4.960995	91410.3	299902
	121 46 08.254	83 00 38.4	261 38 34.5	Roman.....	5.202201	159284.6	522619
		83 17 03.4	262 21 45.1	Spencer.....	5.029801	107102.8	351386
		115 41 46.4	294 51 20.7	Peterson.....	5.024583	105823.7	347190
Middle Sister, 1903....	44 08 55.768	48 29 01.0	227 52 52.6	Fairview.....	4.971957	93746.9	307568
	121 46 59.750	80 32 32.2	259 37 48.4	Spencer.....	5.028044	106670.4	349068
		81 09 56.6	259 48 26.5	Roman.....	5.200978	158846.6	521149
		113 27 24.0	292 37 43.2	Peterson.....	5.011607	102708.7	336970
North Sister, 1903.....	44 10 01.464	47 57 31.4	227 20 53.1	Fairview.....	4.981379	95808.0	314314
	121 46 17.183	79 34 17.3	258 39 03.3	Spencer.....	5.033231	107952.1	354173
		80 30 32.5	259 08 32.0	Roman.....	5.204400	160108.2	525272
		112 13 06.1	291 22 55.0	Peterson.....	5.011964	102793.1	337247
Nebo, 1903 ¹	44 09 27.05	356 25 48	176 27 50	Fairview.....	4.808430	63596.0	208648
	122 42 05.14	58 36 38	238 20 13	Spencer.....	4.567857	36970.6	121204
Herman Peak, wood- ed summit, 1903. ¹	44 07 29.14	220 51 52	41 11 10	Mary.....	4.748023	55978.7	183657
	124 00 43.71	316 51 55	137 03 22	Roman.....	4.508753	32266.6	105861
Prairie Peak, west tree, 1903.	44 16 42.307	14 21 17.1	194 15 52.7	Roman.....	4.622824	41968.9	137660
	123 36 28.771	190 06 28.8	10 08 50.8	Mary.....	4.407496	25556.2	83946
		308 24 09.5	128 45 35.9	Spencer.....	4.720497	52540.8	172378

¹ Checked by vertical angles only.

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
<i>Supplementary points—Continued.</i>							
Alsea Peak, partly cleared wooded summit, 1904.	44 25 27.821	227 11 02.2	47 16 06.3	Mary.....	4.119275	13160.6	43178
	123 40 22.746	270 03 23.6	80 33 01.0	Peterson.....	4.755064	56396.3	186667
		5 12 21.3	185 09 39.5	Roman.....	4.756721	57111.2	187372
Cannibal Peak highest wooded summit 1903 ¹ .	44 28 33.48	261 49 41	82 01 38	Mary.....	4.359838	22836.9	74924
	123 50 09.03	352 48 28	172 52 35	Roman.....	4.800029	63099.9	207020
Mount Washington, 1903.	44 19 57.346	38 32 25.7	217 58 29.8	Fairview.....	5.023694	105607.3	346480
	121 50 15.638	69 20 51.5	248 28 18.8	Spencer.....	5.032546	107781.9	353614
		78 35 56.4	252 16 34.7	Roman.....	5.201576	159065.5	521867
		93 34 49.1	277 22 50.5	Mary.....	5.139352	137832.6	452206
		102 47 18.1	281 59 49.4	Peterson.....	4.964639	92180.5	302429
Hayrick, 1908.....	44 28 46.040	33 29 07.0	212 55 19.5	Fairview.....	5.074123	118610.5	389641
	121 50 31.724	61 36 02.5	240 43 36.8	Spencer.....	5.057844	114246.8	374825
		68 06 14.2	246 45 57.3	Roman.....	5.215053	164090.3	538353
		91 47 12.3	270 35 19.1	Mary.....	5.133540	136000.2	446194
Left Nipple, 1903....	44 29 46.672	36 09 59.1	215 48 15.8	Spencer.....	4.848359	70527.6	231389
	123 34 33.718	90 58 23.5	270 17 21.8	Mary.....	4.869812	77691.1	254853
		92 54 31.7	272 37 01.5	Peterson.....	4.494486	31228.8	102440
		144 40 08.0	324 16 10.6	Yam.....	4.887624	77201.2	253284
Lebanon, tall brick chimney, 1903 ¹ .	44 32 58.43	49 46 03	229 43 21	Peterson.....	3.825583	6694.0	21962
	122 54 14.18	84 42 42	264 15 27	Mary.....	4.713997	51724.6	169700
Corvallis closed cupola, 1903 ¹ .	44 33 59.92	234 17 14	104 30 04	Peterson.....	4.396558	25085.6	82138
	123 16 23.92	72 50 89	262 38 56	Mary.....	4.364754	23169.8	75987
Corvallis open cupola, 1903 ¹ .	44 33 55.89	283 44 22	103 57 28	Peterson.....	4.406228	25481.7	83601
	123 16 46.16	72 46 27	252 35 00	Mary.....	4.355167	22655.2	74328
Albany courthouse cupola, 1903 ¹ .	44 38 05.82	321 24 27	141 30 17	Peterson.....	4.247040	17662.0	57946
	123 06 24.31	67 54 06	247 35 22	Mary.....	4.581843	38180.6	125264
Forest Peak, tallest trees, 1903.	44 40 22.978	40 55 31.0	220 46 56.5	Mary.....	4.399952	24714.5	81084
	123 20 52.941	200 27 53.5	20 36 24.5	Yam.....	4.664792	46215.9	151627
		237 04 37.3	57 31 29.5	Hult.....	4.776125	59720.7	195934
Round Peak, 1903....	44 37 52.709	66 32 19.8	246 16 03.4	Peterson.....	4.526021	33998.2	110992
	122 34 54.345	80 00 05.7	259 19 15.6	Mary.....	4.802838	78313.7	256934
		137 24 19.3	317 00 34.8	Yam.....	4.814998	65297.7	214231
		172 28 37.1	352 21 28.2	Barnes.....	5.001722	100397.3	329887
Thomas, cairn, 1908.	44 38 10.938	66 11 53.3	245 55 12.3	Peterson.....	4.569950	34431.0	112962
	122 34 19.315	79 42 15.8	259 01 01.0	Mary.....	4.898576	79172.8	259753
		136 34 51.0	316 10 41.7	Yam.....	4.815663	65412.8	214608
Mount Jefferson, 1903.	44 40 29.156	53 50 37.1	232 56 16.5	Spencer.....	5.109880	128780.4	422537
	121 47 55.280	79 17 59.6	268 28 43.7	Peterson.....	4.976073	94639.6	310497
		82 53 24.4	261 39 34.1	Mary.....	5.147584	140470.1	460859
		112 33 05.6	291 36 11.6	Yam.....	5.050309	114632.8	376091
		141 59 59.6	321 19 33.6	Barnes.....	5.091770	120717.4	396654
		166 43 29.4	346 31 14.3	Larch.....	4.991509	98063.9	321731
Monmouth Peak, 1903.	44 47 51.810	226 50 08.6	47 07 03.9	Yam.....	4.634728	43124.9	141486
	123 32 31.994	101 14 11	74 36 21.4	Hult.....	4.833036	64082.6	223368
		1 18 42.3	181 18 18.6	Mary.....	4.512641	32556.7	106813
Salem Capitol, dome, 1903 ¹ .	44 56 19.47	146 50 53	326 46 02	Yam.....	4.215764	16434.8	53920
	123 01 43.50	268 37 32	83 50 56	Hult.....	4.399597	25095.6	82334
Chemawa tank, 1903. ¹	45 00 11.41	119 19 23	299 13 08	Yam.....	4.129850	13485.0	44242
	123 59 36.91	281 11 15	101 23 10	Hult.....	4.354021	22595.5	74132
Table Rock, cairn, 1903.	44 58 14.226	62 41 39.8	241 49 11.6	Mary.....	5.040664	111189.6	364796
	123 18 33.078	88 41 38.0	268 24 31.6	Hult.....	4.502985	31840.9	104465
		99 07 35.3	278 32 12.5	Yam.....	4.822846	66503.7	218188
		150 54 46.0	330 35 59.0	Barnes.....	4.850287	70841.4	232419
Arquet, cairn, 1903..	45 04 19.542	71 29 82.7	251 10 17.5	Hult.....	4.576875	37746.4	123840
	122 15 32.310	89 25 06.6	238 48 33.9	Yam.....	4.842732	69319.7	228411
		142 51 42.3	322 30 45.8	Barnes.....	4.803044	63539.5	208463

¹ Checked by vertical angles only.

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
<i>Supplementary points—Continued.</i>							
White church spire, west of Brooks, 1903. ¹	45 07 25.83 122 56 30.05	314 34 45 66 46 58	134 44 28 246 38 20	Hult..... Yam.....	4.404325 4.286586	26370.3 17241.9	83236 56568
Fairdale Peak, 1903. ¹	45 15 09.97 123 14 10.05	307 47 30 340 50 21	128 09 44 160 54 19	Hult..... Yam.....	4.718211 4.349885	52265.0 22381.3	171473 73429
Sheridan Peak, high- est greentree, 1903. ¹	45 16 53.64 123 26 49.37	301 12 17 315 24 22	121 43 31 135 37 19	Hult..... Yam.....	4.830874 4.538082	67744.5 34126.7	222258 111961
Squaw, cairn, 1903....	45 18 51.206 122 02 24.710	78 12 49.8 120 51 29.4 173 47 48.4	287 85 55.7 300 21 10.6 358 45 48.7	Yam..... Barnes..... Larch.....	4.948008 4.810210 4.528919	88717.2 64596.7 33990.2	291036 211931 110693
Eagle cairn, 1903 ¹ ...	45 16 25.38 122 04 54.19	118 29 55.3 179 11 18.5	298 01 22.8 359 11 05.1	Barnes..... Larch.....	4.773837 4.460062	59406.9 28844.4	194904 94634
Mount Hood, peak, 1903.	45 23 27.122 121 41 48.696	73 33 10.7 102 00 29.2 102 50 31.8 120 13 06.7	252 31 35.7 281 15 27.4 282 07 15.7 299 56 25.9	Yam..... Barnes..... Balch..... Larch.....	5.074616 4.924867 4.908772 4.547322	118745.2 84113.8 84668.5 35203.2	389583 275933 266923 115093
Fir, 1903.....	45 31 23.055 122 44 46.238	295 11 61.5 8 09 28.8	115 11 39.9 188 09 28.5	Cem..... Hill.....	3.111504 3.128313	1286.0 1343.7	4242 4408
Monument, General Land Survey, 1903.	45 31 11.933 122 44 34.806	23 58 29.5 144 09 14.0	208 68 15.0 394 69 06.8	Hill..... Fir.....	3.038393 2.638968	1079.9 426.6	3543 1390
Hill, 1903.....	45 30 39.970 122 44 55.023	176 26 18.0 240 10 43.2	356 26 14.4 60 11 27.9	Barnes..... Cem.....	3.242892 3.195468	1749.4 1553.4	5739 5146
Cem, 1903.....	45 31 05.230 122 48 52.328	123 20 05.0 198 44 48.5	303 19 16.7 18 45 58.8	Barnes..... River.....	3.245153 3.822185	1758.5 6640.3	5779 21786
River, 1903.....	45 34 28.894 122 43 13.910	285 42 28.7 34 07 13.5	105 48 25.4 214 65 14.9	Rocky Butte.. Barnes.....	4.0514797 3.8079902	11258.5 6426.7	36937 21085
Oregonian, 1903.....	45 31 12.209 122 40 38.967	161 11 63.4 251 11 25.6	341 09 55.6 71 16 14.4	River..... Rocky Butte.. Barnes.....	3.8050089 3.9672517	6382.8 9273.7	20941 30425
Portland longitude station, 1887.	45 31 08.82 122 40 39.75						
Portland latitude station, 1887.	45 31 08.82 122 40 39.84	187 56 52	7 56 53	Oregonian....	2.13537	136.6	448
Portland bench mark (U.S.G.S.), 1903.	45 31 09.07 122 40 39.77			Oregonian....	2.10969	128.7	422
Rocky Butte (Oreg.) 1889.	45 32 49.861 122 33 54.308	81 09 27.93 140 59 23.21 177 15 37.04	261 01 32.80 320 46 20.26 357 14 17.96	Barnes..... Warren..... Davis.....	4.1649670 4.5744937 4.6962679	14620.66 37359.95 49689.84	47967.9 123162.3 163024.1
Harney (Wash.), 1881.	45 37 21.734 122 37 53.538	328 15 53.08 40 59 24.33	148 18 43.96 220 54 19.74	Rocky Butte.. Barnes.....	3.9941643 4.1495337	9866.53 14110.22	32370.4 46293.3
Balch (Oreg.), 1881..	45 31 54.574 122 42 30.763	80 15 16.28 210 43 44.61 261 17 15.30	260 13 29.77 30 47 02.60 81 23 23.91	Barnes..... Harney..... Rocky Butte.. Barnes.....	3.5167584 4.0701684 4.0543981	3286.69 11753.53 11334.39	10733.1 38561.4 37180.2
Vancouver Barracks flagstaff west, 1903. ¹	45 37 87.91 122 39 36.04	282 39 59.2 32 13 36.7	102 41 12.5 212 09 45.3	Harney..... Barnes.....	3.357196 4.120055	2276.1 13184.2	7468 43255
Warren schoolhouse cupola, 1903. ²	45 48 47.53 122 51 13.32	345 42 09.3 69 43 50.8	165 47 36.3 249 43 11.1	Barnes..... Warren.....	4.516405 3.105229	32840.1 1274.2	107743 4180
Mitchell, 1903 ¹	46 01 53.00 122 11 31.94	37 55 27 65 03 29	217 31 27 244 34 18	Barnes..... Warren.....	4.850600 4.763619	70902.3 58025.5	232619 190372
Mount Adams, 1903..	46 12 12.133 121 29 24.899	32 05 53.1 52 09 53.4 52 54 14.0 152 03 49.2	211 40 11.3 231 17 41.3 231 59 59.1 331 44 15.5	Larch..... Balch..... Barnes..... Bel.....	4.943096 5.080990 5.091261 4.864850	87719.5 120500.8 123334.6 73257.2	287793 395343 404904 240345

¹ Checked by vertical angles only.² No check on this position.

Geographic positions—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.		
					Log (meters).	Meters.	Feet.
<i>Supplementary points—Continued.</i>							
Mount St. Helena, 1908.	46 11 53.028	353 45 05.3	173 49 32.9	Larch.....	4.871174	74331.7	243870
	122 11 25.864	30 24 56.9	210 60 51.4	Barnes.....	4.986196	96386.8	283257
		161 21 14.0	341 09 50.7	Hal.....	4.796451	62562.2	205322
		196 21 43.7	16 32 38.5	Bel.....	4.832490	67997.0	223087
Min, 1906.....	46 18 55.031	36 54 48.26	216 54 40.53	Len.....	2.5806528	380.7	1249
	122 07 49.822	195 35 51.96	15 44 10.73	Bel.....	4.7339685	54196.2	177809
Deschutes Peak, 1905.	46 39 25.252	141 03 59.3	321 00 10.8	Hal.....	4.026508	10607.4	34801
	122 21 54.262	166 44 01.2	346 37 33.9	Hurst.....	4.688278	48784.1	160052
		246 15 51.1	66 34 26.0	Bel.....	4.550058	35486.1	116424
Mineral Peak, 1905 ¹ ..	46 38 56.26	150 54 20	330 38 47	Hurst.....	4.743674	55420.9	181827
	122 09 27.44	227 45 19	47 54 50	Bel.....	4.351832	22481.8	73759
High Rock, 1905.....	46 41 06.848	97 08 52.2	276 44 46.4	Hal.....	4.028450	42506.0	139455
	121 54 01.859	133 47 15.3	313 20 27.1	Hurst.....	4.806714	64374.5	211202
		104 54 38.5	344 52 50.9	Bel.....	4.000194	11486.7	37086
Goat Mountain, 1905 ¹	46 46 23.95	83 54 44	263 30 26	Hal.....	4.630098	42726.6	140179
	121 53 47.26	111 01 08	290 59 15	Bel.....	3.548435	3535.4	11599
Mount Rainier, high peak, 1906.	46 51 09.215	75 59 36.2	255 29 12.0	Hal.....	4.738514	54766.4	179679
	121 45 25.562	114 28 27.3	298 50 19.5	Hurst.....	4.799232	62964.3	206641
Mount Rainier, bare summit, 1906.	46 51 11.106	75 48 48.0	255 18 39.5	Hal.....	4.735119	54239.9	178280
	121 45 47.001	114 30 34.9	298 57 42.7	Hurst.....	4.799203	62546.5	206205
Sharp peak, 1906.....	47 01 04.392	8 27 57.5	188 25 44.7	Bel.....	4.418390	26205.4	85976
	121 53 20.964	53 37 01.4	233 12 21.8	Hal.....	4.728060	53466.3	175414
		99 03 14.7	278 35 52.2	Hurst.....	4.680627	47932.2	157258
Tacoma City Hall, 1905.	47 15 28.463	177 53 26.9	357 53 20.8	Dron.....	3.672844	4708.1	15446
	122 26 20.264	187 00 33.5	7 00 52.6	Gull.....	3.651667	4484.0	14711
		267 03 27.6	77 05 53.5	Bos.....	3.631972	4285.2	14059
		326 42 26.2	146 43 27.2	Kin.....	3.508746	3182.3	10441
Tacoma courthouse, 1905.	47 15 12.780	122 44 24.8	302 42 41.3	Wash.....	3.546524	3519.8	11548
	122 26 43.527	191 51 19.7	11 51 55.9	Gull.....	3.703943	5042.5	16544
		314 12 45.2	134 14 03.3	Kin.....	3.494135	3119.9	10236
Smelter stack, 300 feet high, 1905.	47 17 51.813	196 41 00.6	16 41 40.6	Neill 2.....	3.599017	3972.1	13032
	122 30 23.274	247 07 19.4	67 10 45.5	Dash.....	3.805562	6399.9	20967
		331 07 48.6	151 08 46.6	Wash.....	3.535934	3435.1	11270
Brown Point Light- house, 1906.	47 18 23.031	38 04 48.2	218 02 59.4	Wash.....	3.702914	5045.6	16554
	122 26 36.330	128 05 49.9	308 03 43.0	Neill 2.....	3.633308	4605.8	15111
		109 04 31.7	349 04 03.4	Piner 2.....	3.630626	4271.9	14015
Dash, 1857.....	47 19 12.171	37 39 18.36	217 36 50.30	Wash.....	3.8408923	6882.54	22744.5
	122 25 42.896	105 35 50.58	285 32 04.37	Neill 2.....	3.6926708	4928.00	16167.9
Piner 2, 1905.....	47 20 38.852	324 10 34.26	144 11 41.91	Dash.....	3.5186600	3301.11	10830.4
	122 27 14.898	15 44 13.69	195 42 53.22	Wash.....	3.9286282	8484.54	27886.4
		64 19 31.98	244 17 53.39	Neill 2.....	3.4945984	3123.19	10246.7
Robinson 2, 1867.....	47 23 11.720	28 27 36.29	208 25 15.86	Dash.....	3.9249652	8413.26	27602.6
	122 22 31.984	51 32 05.89	231 28 37.75	Piner 2.....	3.8796391	7584.71	24884.2

¹ No check on this position.² Checked by vertical angles only.

ELEVATIONS.

The datum for all the elevations is mean sea level.

The stations are in three classes: First, those fixed directly by the spirit leveling, and of which the elevations are subject to a probable error varying from ± 0.15 to ± 0.3 meter; second, the stations in the main scheme fixed by reciprocal measures of vertical angles and which are subject to probable errors varying from ± 0.2 to ± 1.1 meters, and, third, the intersection stations, of which the elevations are fixed by measurements of vertical angles which are not reciprocal, the intersection stations not being occupied, and whose elevations are subject to probable errors which may be as great as ± 3 meters in some cases.

The accuracy with which each elevation in the main scheme is determined depends mainly upon the remoteness of that station from the nearest one of which the elevation is fixed by spirit leveling, as indicated in class 1 of the following table. Station Snow Mountain west is probably least accurately determined of all the stations in the main scheme.

Table of elevations.

THIRTY-NINTH PARALLEL TO WILLAMETTE BASE.

Station.	Point to which elevation refers.	Elevation.		Station.	Point to which elevation refers.	Elevation.	
<i>Class 1.</i>				<i>Class 2—Contd.</i>			
Redding astro- nomic station.	Station mark	<i>Meters.</i> 202. 16	<i>Feet.</i> 663. 3	Roman.....	Station mark	<i>Meters.</i> 572. 3	<i>Feet.</i> 2862
Gazelle astronomic station.	.....do.....	848. 28	2783. 1	Spencer.....	.....do.....	626. 2	2054
Central Point astro- nomic station.	.....do.....	369. 92	1213. 6	Mary.....	.....do.....	1248. 8	4097
Roseburg latitude station.	.....do.....	165. 24	542. 1	Peterson.....	.....do.....	437. 2	1434
Willamette north base.	.....do.....	101. 36	332. 5	Twin.....	.....do.....	389. 8	1279
Willamette south base.	.....do.....	116. 59	382. 5	Ridge.....	.....do.....	361. 0	1184
<i>Class 2.</i>				Rauch.....	.....do.....	202. 2	663
Mount Helena.....	.....do.....	1322. 1	4338	<i>Class 3.</i>			
Snow Mountain, west.	Top of pier..	2145. 7	7040	Lassen Peak.....	Top.....	3189. 9	10466
Snow Mountain, east.	Station mark	2150. 6	7056	Mount Linn.....	.....do.....	2463. 8	8063
Marysville Butte.....	.....do.....	638. 0	2093	Mount St. John.....	.....do.....	2057. 6	6751
Kent.....	.....do.....	2032. 9	6670	Bully Choop.....	.....do.....	2126. 8	6978
Lyons.....	.....do.....	2031. 4	6665	Crater Peak.....	.....do.....	2646. 5	8683
Bally.....	.....do.....	1892. 4	6209	Saw Tooth.....	Summit.....	2717. 4	8915
Round.....	.....do.....	1043. 4	3423	Thompson Peak.....	Top.....	2555. 0	8383
Spur.....	.....do.....	2766. 9	9078	Russian Peak.....	Highest sum- mit.	2494. 3	8183
Boliver.....	.....do.....	2451. 5	8043	.....north point.	Summit.....	1803. 9	5918
Mears.....	.....do.....	2174. 1	7133	Pilot Rock.....	.....do.....	2606. 2	8551
Sterling.....	.....do.....	2239. 3	7347	China Mountain.....			
Soda.....	.....do.....	1857. 4	6094	Ashland Peak.....	.....do.....	2296. 7	7535
Onion.....	.....do.....	1597. 1	5240	Marble Mountain.....	.....do.....	2533. 3	8311
Rust.....	.....do.....	1891. 2	6205	Mount Eddy.....	.....do.....	2754. 8	9038
White.....	.....do.....	1222. 7	4011	Mount Shasta.....	Top of peak.....	4316. 3	14161
Black.....	.....do.....	1874. 1	6149	Goose Nest.....	Tree-top.....	2398. 5	7899
Scott.....	.....do.....	1294. 6	4247	Redding Court- house.	Tangent to roof.	198. 2	650
Burg.....	.....do.....	608. 7	1997	Little Shasta.....	Top of peak.....	2532. 9	8310
Rose.....	.....do.....	453. 3	1487	Black Butte.....	Top of caln.....	1933. 8	6344
Fairview.....	.....do.....	1806. 3	5926	Preston Peak.....	Top of peak.....	2232. 2	7323
Yellow.....	.....do.....	746. 3	2448	Greyback.....	.....do.....	2149. 5	7052
				Siskiyou.....	.....do.....	2178. 4	7147
				Wagner.....	Highest sum- mit.	2211. 4	7255
				Kerby.....	Top.....	1689. 5	5543
				Mount Pitt.....	Summit.....	2893. 6	9493
				Lost Peak.....	Top.....	2446. 2	8026

THIRTY-NINTH PARALLEL TO WILLAMETTE BASE—Continued.

Station.	Point to which elevation refers.	Elevation.		Station.	Point to which elevation refers.	Elevation.	
Class 3—Contd.				Class 5—Contd.			
Aspen Peak.....	Top.....	Meters. 2502.0	Feet. 8209	Prairie Peak.....	Top of peak.	Meters. 1047.6	Feet. 3437
Mount Scott.....	Top of peak.	2717.7	8916	Alsea Peak.....	do.....	1100.8	3612
Liao Rock.....	Top.....	2484.0	8150	Chambliss Peak.....	do.....	899.4	2852
High Rock (Oreg.).....	do.....	1893.8	6213	Herman Peak.....	do.....	634.7	2082
Union Peak.....	do.....	2347.9	7703	Seavies (U.S.G.S.).....	do.....	607.3	1992
Old Bailey.....	do.....	2548.3	8361	Mount Jefferson.....	do.....	3207.2	10522
Dodson (U. S. G. S.).....	Top of peak.	984.5	3230	Left Nipple.....	do.....	1243.4	4079
Diamond Peak.....	do.....	2679.7	8792	Corvallis closed cupola.	Bottom of cupola, top of roof.	96.3	316
Quartz.....	do.....	1686.4	5533	Corvallis open cupola.	do.....	98.2	322
Mount Washington.....	do.....	2368.0	7769	Albany courthouse.	Base, large cupola.	88.1	289
Mount Zion.....	Top of peak.	1406.4	4614	Lebanon.....	Top of tall brick chimney.	135.3	444
North Sister.....	do.....	3068.4	10067	Salem, Capitol.....	Top, large part of dome.	100.4	329
Hayrick.....	do.....	2375.2	7793				
Middle Sister.....	do.....	3059.6	10038				
Nebo.....	do.....	1037.4	3404				
South Sister.....	do.....	3155.2	10352				
Ball Butte.....	do.....	2736.6	9044				
St. Mary Butte.....	do.....	2789.6	9152				

WILLAMETTE BASE NET TO TACOMA BASE.

<i>Class 1.</i>				<i>Class 3.</i>			
Oregonian.....	Top of tower.	69.22	227.1	Round Peak.....	Top of peak.	1312.8	4307
<i>Class 2.</i>				Thomas.....	do.....	1320.5	4332
Yam.....	Station mark.	354.4	1163	Forest Peak.....	do.....	671.9	2204
Hult.....	do.....	383.3	1258	White church spire.	Top of square part.	72.0	236
Barnes.....	do.....	383.5	1258	Monmouth Peak.....	Top of peak.	984.6	3230
Larch.....	do.....	1234.9	4052	Table Rock.....	do.....	1487.8	4881
Warren.....	do.....	38.9	126	Arquett, cairn.....	do.....	1417.4	4650
Rocky Butte.....	do.....	185.3	608	Squaw.....	do.....	1455.9	4777
River.....	do.....	50.2	165	Chemawa tank.....	Foot of tank, top of tower.	77.0	253
Harney.....	do.....	38.7	127	Sheridan Peak.....	Top of peak.	941.1	3088
Davis.....	do.....	900.3	2954	Fairdale.....	do.....	780.5	2561
Star.....	do.....	1328.7	4359	Mount Hood, peak.....	do.....	3421.2	11224
Red.....	do.....	1517.3	4978	Mount Adams.....	do.....	3757.0	12326
Lam.....	do.....	1383.1	4538	Mount St. Helens.....	do.....	2955.6	9697
Len.....	do.....	1785.6	5858	Deschutes Peak.....	do.....	1318.8	4327
Toutle.....	do.....	1001.7	3296	High Rock (Wash.).....	do.....	1733.5	5687
Huck.....	do.....	1160.9	3809	Sharp Peak.....	do.....	1769.4	5805
Hal.....	do.....	1107.5	3634	Mineral Peak.....	do.....	1444.5	4746
Bel.....	do.....	1699.1	5476	Mount Rainier.....	Bare summit.	4389.5	14401
Rain.....	do.....	538.0	1765	Mount Rainier.....	Highest point.	4410.7	14471
Pen.....	do.....	282.1	926	Goat Mountain.....	Top of peak.	1847.8	6062
Cem.....	do.....	325.8	1069	Mitchell.....	do.....	1213.7	3982
Hill (Oreg.).....	do.....	296.8	974	Eagle, cairn.....	do.....	1283.0	4209
Fr.....	do.....	345.9	1135				
Monument, General Land Survey.	do.....	289.7	950				

TACOMA BASE TO PUGET SOUND.

<i>Class 1.</i>				<i>Class 2—Contd.</i>			
Tacoma city hall...	U. S. G. S. B. M.	33.52	110.0	Tacoma astronomic	Station mark	94.79	311.0
<i>Class 2.</i>				Tacoma north base.....	do.....	124.70	404.1
Gull.....	Station mark.	51.67	169.5	Burn.....	do.....	122.14	400.7
Dron.....	do.....	27.59	90.5	Tacoma south base.....	do.....	122.57	402.1
Bos.....	do.....	2.59	8.5	Hurst.....	do.....	129.20	423.9
Kln.....	do.....	102.46	336.2	<i>Class 3.</i>			
Wash.....	do.....	115.86	380.1	Smelter stack.....	Top of stack.	132.7	435
Smelt.....	do.....	96.14	315.4	Brown Point Light-house.	Top of light shaft.	8.5	28
Neill 2.....	do.....	4.02	13.2	Tacoma courthouse	Top of cupola	153.1	502
Dash.....	do.....	2.38	7.8				
Piner 2.....	do.....	12.24	40.2				

DESCRIPTIONS OF STATIONS.

This list may be conveniently consulted by reference to the illustrations at the end of this publication or to the index. All azimuths given in the descriptions are reckoned continuously from true south around by west to 360°, south being 0°, west 90°, north 180°, and east 270°. Where magnetic azimuths are given they are indicated as such. The distance between the station and reference mark is measured horizontally unless otherwise stated in the description.

In general, except where the contrary is specifically stated, the surface and underground mark are not in contact, so that a disturbance of the surface mark will not necessarily affect the underground mark. The underground mark should be resorted to only in cases where there is evidence that the surface mark has been disturbed.

The name and dates given in each description immediately after the county refer to the chief of party by whom the station was established, the date of the establishment of the station, and the date when the station was last recovered.

Any person who finds that one of the stations herein described has been disturbed or that the description no longer fits the facts is requested to send such information to the Director, Coast and Geodetic Survey, Washington, D. C.

MARKING OF STATIONS.

The old type of station mark referred to in the following notes and descriptions consists of a disk and shank made of brass and cast in one piece. The disk is about 85 mm. in diameter and has a polished center surrounded by the raised letters "U. S. C. & G. S." and a raised flange around the edge. The shank is 25 mm. in diameter and 75 mm. long, with a slit at the lower end into which a wedge is inserted so that when it is driven into a drill hole in the rock it will bulge at the bottom and so hold the mark securely in place.

GENERAL NOTES IN REGARD TO STATION MARKS.

Note 1.—A three-eighths-inch copper bolt 3 inches long is cemented into a drill hole in the rock, and directly above the bolt in the same drill hole is cemented an old-type station mark, described in the preceding paragraph. A cross in the top of the copper bolt and another in the polished center of the disk mark the station.

Note 2.—This marking is similar to that described in note 1, except that the copper bolt and the disk are in separate bowlders and the boulder containing the bolt is at some distance beneath the surface. The cross on the disk is directly above the one on the bolt. The dimensions of the bowlders are given in the description of the station.

Note 3.—The station is marked by an old-type station mark, described above, cemented into a drill hole in the rock. No underground mark was used.

REFERENCE MARK.

Note 4.—This mark is a drill or punch hole in the top of a three-eighths-inch copper bolt 3 inches long, which is leaded or cemented into a drill hole in a rock with the top of the bolt flush with the surface.

PRINCIPAL POINTS.

Mount Helena (Napa County, Calif., W. Elmbeck, 1876; 1908).—On the summit of Mount Helena, about 12 miles to the northward of Calistoga. The 97454°—22—4

station was originally marked by a fine drill hole and cross in the top of a one-half-inch copper bolt 5 inches long, which was cemented in a drill hole in bedrock, and by a brick pier 3 bricks square and 43 inches high, built over the bolt. When visited in 1908 it was found that the pier had been dynamited. Other instrument piers are at the following distances and directions from the station: Collimator pier, 2 bricks square and 61 inches high, 2.27 meters northwest; transit pier, 2 by 3 bricks and 39 inches high, 17.04 meters southwest; latitude pier, 2 by 2½ bricks and 36 inches high, 17.74 meters southwest of the station, and 1.68 meters east of the transit pier; vertical angle pier, 2 bricks square and 44 inches high, 33.31 meters southwest of the station and 16.92 meters a little south of east of the latitude pier. A boundary mark between Lake and Napa Counties, a large drill hole in a basaltic rock, is 2.18 meters northwest of the station.

Marysville Butte (Sutter County, Calif., W. Eimbeck, 1876; 1904).—About 15 miles west of Marysville on the southeastern summit of the south butte of the Marysville Buttes, about 6 meters northeast of the highest part of the summit, and near the steep cliff on the north side. The station is marked by an old-type station mark, described on page 23, set in a drill hole in a small rock embedded in the concrete that fills a depression in the solid rock. Below the concrete and directly under the station mark is a three-eighths-inch copper bolt 3 inches long set in a drill hole in the solid rock. Three reference marks, each of which is a three-eighths-inch copper bolt 3 inches long set in a drill hole in the rock, are at the following distances and azimuths from the station: 2.470 meters, 246° 48'; 2.635 meters, 5° 06'; and 2.915 meters, 103° 07'.

Snow Mountain west (Glenn and Lake Counties, Calif., E. F. Dickens, 1892; 1904).—On the highest point of the southwest summit of Snow Mountain. The summit is about 300 meters long in a northwest and southeast direction and about 50 meters wide at the station and is covered with small broken stones. There are a few scrub pines just below the pitch of the ridge about 100 meters southeast of the station. The station is marked by a one-half-inch brass bolt 3 inches long in a drill hole in the solid outcropping rock, and by a concrete pier 12 inches square and 44 inches high having embedded in its top a brass bolt directly above the one in the solid rock.

Snow Mountain east (Glenn County, Calif., W. Eimbeck, 1876; 1904).—On the northernmost rock-croppings at the edge of the summit of the eastern peak of Snow Mountain, about 5 miles south of Mount St. John and near the corner of Lake, Colusa, and Glenn Counties. The station is marked by a half inch copper bolt cemented in a drill hole in a hollow at about the middle of the highest point of rocks, with the top of the bolt about a half inch above the surface and marked by a cross. The reference marks are all drill holes in rocks, the first being distant 5.16 meters in azimuth 59° 57', the second 3.33 meters in azimuth 165° 39', and the third 6.89 meters in azimuth 248° 38'.

Kent (Tehama County, Calif., O. B. French, 1904).—On a high ridge about 8 or 10 miles east by south from Mount Linn and about 18 miles by road in a northwesterly direction from Paskenta, on a peak locally known as Bald Rock, on a ledge on the east side of the summit and about 8 or 9 feet lower than its highest part. Four or five hundred feet to the westward of the station and about 50 or 60 feet lower is a large, prominent, rocky knob. The station is marked according to note 1. The reference marks are described in note 4. The first one is in a large rock distant 5.01 meters in azimuth 212° 40', the second in a flat ledge distant 70.19 meters in azimuth 285° 50', and the third on the largest part of the ledge distant 47.72 meters in azimuth 5° 17'.

Lyons (Tehama County, Calif., O. B. French, 1904).—About 5 miles east of Lyonsville post office on a ridge known locally as Bald Hill, about 300 yards from the summit of the ridge on the shoulder extending toward Lyonsville and in the middle of a large group of boulders. A lone fir tree stands about 50 meters south by east from the station. The station is marked according to note 1. Two reference marks described in note 4, are in large rocks and at the following distances and azimuths from the station: 29.69 meters, 126° 59'; and 20.22 meters, 332° 22'.

Bally (Shasta County, Calif., O. B. French, 1904; 1920).—On the northernmost of the two main peaks on the summit of Bally Mountain, a prominent and well-known mountain about 15 miles by road west of Redding. The station mark, described in note 1, is in the top of a rock on the north side of the most prominent group of rocks on the peak and 5 or 6 feet below the top of the

For notes in regard to marking of stations see p. 23.

group. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 4.29 meters, $247^{\circ} 07'$; and 10.62 meters, $154^{\circ} 49'$.

Round (Shasta County, Calif., O. B. French, 1904; 1919).—On the highest part of what is known as Round Mountain just north of the post office of the same name. The station mark, described in note 1, is in a large boulder which projects about 6 inches out of the ground. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 28.72 meters, $345^{\circ} 30'$; and 6.43 meters, $57^{\circ} 13'$. The south reference mark is in the most eastern rock of a prominent group of rocks near the south end of the summit.

Spur (Siskiyou County, Calif., O. B. French, 1904; 1919).—On the west slope of Mount Shasta at an elevation of about 9,100 feet, in a position best identified by approaching the summit from Igema, by the road leading through Kite Canyon. In ascending this route several prominent peaks are discerned ahead and from the right-hand one a narrow shoulder extends in a westerly direction, or toward Black Butte. The station is about 50 meters below an abrupt change of slope of the ridge of this shoulder, and about 1 mile from the peak mentioned above. The station mark, described in note 1, is in the top of a large rock flush with the ground. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 13.77 meters, $165^{\circ} 53'$; and 8.10 meters, $228^{\circ} 47'$.

Mears (Shasta County, Calif., O. B. French, 1904; 1920).—About 4 or 5 miles west by south from Castella and about southwest from Castle Crag, on the southern summit of the highest rocky peaks in the region known locally as Gray Rocks. The station is about 20 feet below the highest part of the peak and near the bluff on the south and east sides, with a ledge 3 or 4 feet higher about 10 feet distant toward the southeast. The peak was approached from the south and the 30-foot bluff near the station surmounted by means of ladders. The station is marked according to note 1. Two reference marks, described in note 4, are located as follows: The first in a boulder near the trail to the station, and distant 7.92 meters in azimuth $70^{\circ} 50'$; and the second, on a low boulder east of a high pointed rock, and distant 17.77 meters in azimuth $143^{\circ} 03'$.

Boliver (Siskiyou County, Calif., O. B. French, 1904; 1920).—On the north side of a large group of boulders about 60 yards northeast of the highest part of the summit of Mount Scott, known locally as Old Craggy or Boliver, which is the high peak about 5 miles in a southerly direction from Callahan. The station is marked according to note 1. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 6.57 meters, $272^{\circ} 41'$; and 9.88 meters, $107^{\circ} 47'$.

Soda (Jackson County, Oreg., O. B. French, 1904).—On a peak known locally as Old Baldy, in the Siskiyou Range of mountains, about 20 miles by road and trail southeast of Ashland and 5 miles east by north from Pilot Rock, a prominent peak in the same range. The best approach is from Ashland via Soda Springs and Davis's ranch. The station mark, described in note 1, is in a large rock whose upper surface is flush with the ground. Two reference marks, described in note 4, are in boulders whose tops are but slightly above ground and at the following distances and azimuths from the station: 12.91 meters, $299^{\circ} 53'$; and 23.95 meters, $35^{\circ} 36'$.

Gazelle astronomic station (Siskiyou County, Calif., O. B. French; 1904; 1908).—About 250 yards north by east from the Gazelle railroad station near the center of the top of a very prominent knoll and about 40 feet northeast of the largest boulder on the knoll. The station mark, described in note 1, is in a rock below the surface of the ground. Three reference marks, described in note 4, are at the following distances and azimuths from the station: 19.20 meters, $290^{\circ} 12'$; and 6.40 meters, $137^{\circ} 39'$. There is a concrete longitude pier, 7.330 meters east and 0.186 meter north of the station. This pier was recovered in 1919.

Sterling (Jackson County, Oreg., O. B. French, 1904).—In the Siskiyou range of mountains, about 25 miles southwest of Ashland and 2 miles west of Mount Sterling, on the northernmost summit of a ridge just south of the Silver Fork basin and at the western end of the long east-and-west valley which is just north of Mount Sterling. The station is about 80 or 90 meters southeast of the highest point of the summit in the center of a group of small boulders. The station mark, described in note 1, is in the top of a large rock. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 34.85 meters, $18^{\circ} 13'$; and 20.44 meters, $136^{\circ} 03'$.

For notes in regard to marking of stations see p. 23.

Rust (Jackson County, Oreg., O. B. French, 1904).—On the highest summit of the peaks known locally as the Black Buttes (Rustler on U. S. Geological Survey maps), about 20 miles north of Mount Pitt and 26 miles by road and trail from Big Butte post office via Parker's ranch. The station is marked according to note 1. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 11.995 meters, $264^{\circ} 33'$; and 10.12 meters, $337^{\circ} 53'$.

Onion (Douglas County, Oreg., O. B. French, 1904).—On the highest part of the bare summit of Onion Springs Mountain, about 1 mile south of the Onion Springs, and best reached from Glendale via Galesville and Gilpatrick's ranch. The station mark, described in note 1, is in a rocky ledge. Two reference marks, described in note 4, are located as follows: One in a prominent ledge and 24.62 meters from the station in azimuth $91^{\circ} 50'$, and the other in an inconspicuous, low boulder at the western edge of the summit and distant 47.22 meters in azimuth $182^{\circ} 47'$.

Black (Douglas County, Oreg., O. B. French, 1904).—Near the northeast corner of the highest part of the summit of Black Rock, a high, prominent, rocky peak about 40 miles in a direct line east of Roseburg and north and northwest of some near-by higher wooded peaks. The station mark, described in note 1, is in the solid rock of the summit. Two reference marks, described in note 4, are also in solid rock and at the following distances and azimuths from the station: 13.78 meters, $4^{\circ} 55'$; and 6.47 meters, $297^{\circ} 45'$.

White (Douglas County, Oreg., O. B. French, 1904).—On the highest part of the summit of White Rock, a prominent peak about 15 miles east of Roseburg. The station mark, described in note 1, is in a large boulder. A reference mark, described in note 4, is in a large boulder just east of a prominent ledge and is 34.44 meters from the station, in azimuth $353^{\circ} 11'$.

Scott (Douglas County, Oreg., O. B. French, 1904).—On the highest part of the summit of Mount Scott, about 20 miles northeast of Roseburg. The station mark, described in note 1, is in a large boulder. Two reference marks, described in note 4, are located as follows: One in a white rock at about the middle of a prominent ledge and 32.71 meters from the station in azimuth $195^{\circ} 02'$; and the other in a rocky ledge near the edge of the brush and 18.17 meters distant in azimuth $305^{\circ} 42'$.

Fairview (Lane County, Oreg., O. B. French, 1904).—On the west side of the summit of Fairview Peak in the Bohemia Mountains, about 25 miles southeast of Cottagegrove and 6 miles by road from Mineral post office. The station mark, described in note 1, is in a boulder. Three reference marks, described in note 4, are in rock ledges and at the following distances and azimuths from the station: 6.69 meters, $74^{\circ} 29'$; 2.92 meters, $181^{\circ} 39'$; and about 175 feet, $266^{\circ} 09'$.

Yellow (Douglas County, Oreg., O. B. French, 1904).—On the highest summit of the timbered ridge about 10 miles west of Yoncalla. The station is marked according to note 2, the subsurface mark in a boulder 8 by 12 by 16 inches placed 18 inches beneath the surface, and the surface mark in a boulder 10 by 20 by 30 inches, the top of which is flush with the surface of the ground. A reference mark, described in note 4, is in a rock ledge and 22.62 meters from the station in azimuth $334^{\circ} 37'$. Two other reference marks, consisting of three-sixteenths inch copper wires 3 inches long set in boulders, are at the following distances and azimuths from the station: 21.04 meters, $197^{\circ} 31'$; and 20.70 meters, $107^{\circ} 02'$.

Spencer (Lane County, Oreg., O. B. French, 1903).—This station is near a United States Geological Survey station. It is on the south end and highest point of the summit of Spencer Butte, about 4 miles south of Eugene. Two trees used by the Geological Survey are at the north end of the summit, which is in the form of a ridge. The station is marked according to note 1. Two reference marks, described in note 4, are in rocks near the station, one distant 5.338 meters in azimuth $175^{\circ} 02'$, and the other 4.570 meters in azimuth $328^{\circ} 51'$. The Geological Survey station is 7.970 meters from the station in azimuth $176^{\circ} 12'$.

Roman (Douglas County, Oreg., O. B. French, 1903; 1906).—On the most westerly of the two summits of the highest peak of the Coast Range, known as Roman Nose or Saddle Mountain, situated near the north line of Douglas County about 5 miles southwest of the junction of Wild Cat Creek with the Siuslaw River. It is on the highest point of the summit, about 6 feet from the southern edge of the bluff and 20 feet from the steep part of the slope east of the

For notes in regard to marking of stations see p. 23.

station. The peak is bare except for a few low shrubs, and has a steep bluff on the south side and a gentle grassy slope on the north side. The station is marked according to note 2, the subsurface mark in a boulder 12 by 12 by 24 inches, 18 inches below the surface, set with the axis east and west, and the surface mark in a boulder measuring about a foot on each side. Two reference marks, described in note 4, are located as follows: One in the nearest outcropping of the solid rock 14.760 meters from the station in azimuth $148^{\circ} 06'$, and the other in a projecting boulder 6.775 meters from the station in azimuth $205^{\circ} 33'$. Arrows pointing to the reference marks are cut in the rock near each mark. An old burned stump is about 5 feet from the station in azimuth 232° .

Mary (Benton County, Oreg., O. B. French, 1903; 1908).—On the highest point of the grassy summit of Mary Peak, about south-southwest from Corvallis. The station is marked according to note 2, the subsurface mark in a flat stone 4 inches thick and 19 inches in diameter, 22 inches below the surface, and the surface mark in a boulder 16 by 18 by 30 inches, the top of which is flush with the surface of the ground. Two reference marks, described in note 4, are in boulders, and at the following distances and azimuths from the station: 13.77 meters, $326^{\circ} 22'$; and 29.36 meters, $58^{\circ} 11'$.

Peterson (Linn County, Oreg., O. B. French, 1903).—About 4 miles southwest of Lebanon on the highest part of the most westerly of the two summits known as Peterson Butte. The station is marked according to note 1. Two reference marks, described in note 4, are located as follows: One in the lower part of the northerly sloping face of the largest rock on the south side of the summit, and 4.645 meters from the station in azimuth $7^{\circ} 30'$; and the other in the ledge just east of the largest rock on the north side of the summit, and 3.270 meters distant in azimuth $185^{\circ} 00'$.

Twin (Linn County, Oreg., O. B. French, 1905).—On the farm of Mr. Gentry near the southwest corner of sec. 24, T. 14, R. 3 W., about 6 or 7 miles from Rowland. It is on the highest summit of a partly wooded ridge, the south slope being bare and the north slope wooded, and about 8 or 10 meters southeast of the highest point of the summit. The station is marked according to note 2, the underground mark in a stone about 2 feet below the surface and the surface mark in a large stone about 6 inches below the surface. Three reference marks, described in note 4, are at the following distances and azimuths from the station: 6.66 meters, $314^{\circ} 42'$; 6.39 meters, $53^{\circ} 57'$; and 6.87 meters, $155^{\circ} 44'$. The last-mentioned reference mark is near the highest point of the summit.

Ridge (Lane County, Oreg., O. B. French, 1905).—On the highest part of a ridge on land owned by Mr. J. J. Winn, about $1\frac{1}{2}$ miles north of his residence, and about 10 miles by road in a northwesterly direction from Junction City. The station is marked according to note 2, with the subsurface mark 1.5 feet below the surface. Three reference marks, described in note 4, are in inconspicuous boulders flush with the surface of the ground, and at the following distances and azimuths from the station: 4.86 meters, $164^{\circ} 32'$; 30.69 meters, $278^{\circ} 43'$; and 9.73 meters, $356^{\circ} 15'$. A triangular blaze in a large maple tree is 11.63 meters from the station in azimuth $92^{\circ} 16'$, and a similar blaze in a large fir tree is 8.45 meters distant in azimuth $213^{\circ} 33'$.

Rauch (Lane County, Oreg., O. B. French, 1903).—About 12 miles west by south from Eugene, $2\frac{1}{2}$ miles southwest of Llewellyn post office and about one-half mile west of the road leading from Llewellyn to Crow post office, on land belonging to Mrs. Frances Rauch. It is about 150 meters east of the summit on the north side of a sloping ridge about 300 feet higher than the valley through which the road runs, the first prominent ridge encountered in going from Llewellyn to Crow and the only ridge in the vicinity from which *Willamette south base* can be seen. The station is about 200 feet west of a point where the ridge becomes steeper. The station was marked according to note 2, the underground mark in a small, flat stone 2 feet below the surface and the surface mark in a rock about 12 by 12 by 18 inches flush with the surface. Two reference marks, described in note 4, are located as follows: One in a rock 10 by 10 by 18 inches on the highest part of the ridge and 11.96 meters from the station in azimuth $286^{\circ} 02'$, and the other in a rock 6 by 8 by 14 inches distant 12.22 meters in azimuth $51^{\circ} 46'$.

Willamette south base (Lane County, Oreg., O. B. French, 1903; 1908).—About 5 miles from Eugene and 220 meters south of the Eugene-Elmira road on land belonging to William Nelson. It is about 100 meters north of a large

For notes in regard to marking of stations see p. 23.

gravel pit, 78 meters from the line fence between William Nelson and M. Nelson, and about in line with the west face of the barn belonging to William Nelson which is 86.79 meters north of the station. The station is marked with old-type station mark described on page 23, placed in the center of a 6-inch drain tile and both embedded in a pillar of concrete 2 feet long, 36 inches in diameter at the base, 18 inches in diameter at the top, and set in the ground so that the tops of the pillar and tile and station mark are all flush with the surface of the ground. Six inches below the foot of this pillar a cross in the top of a $\frac{1}{4}$ -inch copper bolt, embedded in a block of concrete 10 by 24 by 24 inches, forms the subsurface mark. In 1906 a concrete pillar 2 $\frac{1}{2}$ feet high, 18 inches square at the base and 12 inches square at the top, with the letters "U.S.C.S." on the south side, was set over the surface mark. The first reference mark is a $\frac{1}{4}$ -inch copper bolt in a concrete block 12 by 12 by 18 inches, the top of which is flush with the ground, with a similar block and bolt directly beneath it as subsurface mark, distant 212.29 meters from the station in azimuth $177^{\circ} 32' 02''$. The second mark, similar to the first, is at the junction of the road fence and that dividing the farms of William Nelson and M. Nelson, and 225.16 meters from the station in azimuth $200^{\circ} 19' 30''$. The third reference mark, similar to the preceding two but with no subsurface mark, is in the line of the boundary fence 78.38 meters from the station in azimuth $265^{\circ} 16' 42''$. The fourth mark is a $\frac{1}{4}$ -inch copper bolt leaded into a drill hole in a large stone in the southwest corner of the foundation of the main part of William Nelson's barn, and is 86.79 meters from the station in azimuth $181^{\circ} 30' 16''$.

Willamette north base (Lane County, Oreg., O. B. French, 1905; 1908).—One and one-half miles south and one-half mile west of Junction City in the east center of sec. 7, T. 16, R. 4 W., on land owned by Mr. William M. Pittney of Junction City. It is in the northeast corner of a field on the south side of the main east-and-west road, about 71 yards from the north-and-south fence to the east and 4 or 5 yards from the fence on the south side of the road, and almost opposite the main gate which leads into the barnyard corral of the farm across the road. The subsurface station mark is a three-eighths inch copper bolt 6 inches long, set in a block of concrete 3 $\frac{1}{2}$ by 4 feet and 10 inches deep, placed 3 feet below the surface. The surface mark is an old-type station mark described on page 23, set in the top of a concrete pier 3 $\frac{1}{2}$ feet square at the base, 1 $\frac{1}{2}$ feet square at the top, and 2 feet 5 inches deep, the top of which is flush with the surface of the ground. Surrounding the station mark and embedded in the concrete is an 8-inch drain tile 1 foot long with its rim about flush with the top of the pier. Each of the three reference marks consists of two three-eighths inch copper bolts, 3 inches long, each set in the top of a concrete post 1 foot square, the subsurface post being 9 inches long and 2 $\frac{1}{2}$ to 3 feet below the surface, and the surface mark about 2 feet long, with its top 4 inches below the surface. The first reference mark is 6 inches south of the fence on the south side of the road and about in the prolongation of the fence line on the west side of the corral mentioned above, and is 32.058 meters from the station in azimuth $97^{\circ} 10'$. The second mark is in the corral across the road, about 10 inches from the road fence and 6 or 8 feet east of the east end of the main road gate, and is 19.876 meters from the station in azimuth $186^{\circ} 24'$. The third mark is on the south side of the main road, 12 or 15 feet from the road fence, and 6 inches west of the north-and-south fence, at a distance from the station of 65.076 meters in azimuth $271^{\circ} 26'$.

Seavies 2 (Lane County, Oreg., W. H. Burger, 1908).—In the same locality as *Seavies* (U. S. G. S.). (See p. 35.) It is on the south slope of the peak near the lower edge of the first timber from the top and almost in line with *Spencer* (see p. 26) and the tangent line to the west bank of the McKensie River at the big curve in the flat below the station. The station is marked by a drill hole in the rock and by piles of rock around the tripod erected at the station.

Pisgah (Lane County, Oreg., W. H. Burger, 1908).—Located north and east from Goshen on a hill known as Mount Pisgah, about 200 feet southwest, or toward *Spencer Butte*, from the highest point of the hill. The station is on top of a rock about 4 by 6 feet in area, projecting 16 inches above the ground, the largest one of a cluster of rocks, and, with the exception of a large rock on the west slope about 175 feet to the north, the largest rock in the vicinity. Station is marked by a one-half inch drill hole 1 $\frac{1}{4}$ inches deep, 6 inches from the west edge of the rock and 23 inches from its south point.

For notes in regard to marking of stations see p. 23.

Eugene astronomic station (Lane County, Oreg., O. B. French, 1904: 1908).—This station is identical with the United States Geological Survey station. It is on the east end of Skinners Butte, near Eugene, Oreg., just above the reservoir and north of the railroad station, on the site of the old observatory of Oregon State University. It was learned in 1908 that the land was to be converted into a park and that the station would be demolished, so two marble reference stones, projecting 2 inches above the surface and bearing on the top the letters "U. S.," with a cross between, were set to preserve the station. The first, 5 by 5 by 18 inches, is 18.294 meters from the station in azimuth $119^{\circ} 59'$, and the second, 4 by 7 by 14 inches in size, is on the south brow of the hill 12.211 meters from the station in azimuth $52^{\circ} 47'$. A large concrete "O" on the brow of the hill overlooking the railroad station is in azimuth 2° from the station. The distance between the two reference marks is 17.625 meters, and from the first reference mark the Patterson School spire is in azimuth $315^{\circ} 28'$, and the spire of the Humphrey Memorial Methodist Church is in azimuth $353^{\circ} 53'$.

Yam (Polk County, Oreg., O. B. French, 1903: 1908).—On the highest point of the highest of a group of hills about 12 miles northwest of Salem, and about 10 meters south of a wire fence which passes over the summit. A slightly lower wooded hill is about a half mile northwest of the station and a group of hills is about halfway between the station and Salem. The station is marked according to note 2, the surface mark in a boulder 15 by 18 by 18 inches with its top flush with the surface of the ground, and the subsurface mark in a boulder 8 by 16 by 16 inches and 23 inches below the surface mark. Two reference marks, described in note 4, are in boulders about 14 by 18 by 18 inches with their tops flush with the surface of the ground, and with a few loose stones piled about them for identification. One is in the line of the wire fence, 11.06 meters from the station in azimuth $197^{\circ} 10'$, and the other 8.59 meters from the station in azimuth $329^{\circ} 07'$.

Hult (Marion County, Oreg., O. B. French, 1903).—On a prominent bare hill about 6 miles by road and 4 miles in a straight line southeast of Silverton, just south of the road from Silverton to Hult post office and on the farm of Al Porter. It is on the northeast side of the hill and slightly lower than the summit, 17 feet from a line fence on the west, and 8 feet from another fence on the south. The surface and underground marks at this station are crosses cut in the tops of one-half inch copper bolts embedded in boulders, the underground mark being in a boulder about 12 by 14 by 14 inches, with its top 1.9 feet below the surface mark, which is in a boulder about 14 by 18 by 24 inches, with its axis north and south. Two reference marks, described in note 4, are located as follows: One in a boulder about 14 by 16 by 16 inches, set in the fence line 5.79 meters from the station in azimuth $108^{\circ} 55'$, and the other in a boulder about 14 by 16 by 24 inches, set in the fence line 7.125 meters from the station.

Barnes (Multnomah County, Oreg., O. B. French, 1903).—On a cleared hill in azimuth $304^{\circ} 40'$.

about 4 miles west of Portland, between the Barnes and Cornell roads, and just east of the highest hill in this range, which hill is still densely wooded. It is on the south edge of the hill about 100 feet southeast of a fir tree and some small maple trees, and close to the north side of a large stump. The station is marked according to note 2, the surface mark in a stone 8 by 14 by 18 inches with its top flush with the surface of the ground, and the subsurface mark in a stone 6 by 12 by 18 inches $1\frac{1}{2}$ feet below the surface mark. Two reference marks, described in note 4, and set at the roots of stumps on the sides facing the station are located as follows: One in a boulder 15 inches in diameter, distant 15.80 meters from the station in azimuth $156^{\circ} 11'$; and the other in a boulder 12 inches in diameter 7.02 meters from the station in azimuth $233^{\circ} 23'$. A third reference mark consists of a cross in the top of a boulder 10 inches in diameter buried 15 inches beneath the surface and of a copper bolt directly above the cross in a boulder 14 by 14 by 18 inches set with its top flush with the surface of the ground. It is about 3 feet north of the main east-and-west fence line, about 30 feet east of where this fence crosses the highest part of the ridge, about 3 feet east of a fence extending northward from this fence and 44.95 meters from the station in azimuth $184^{\circ} 35'$.

Larch (Multnomah County, Oreg., O. B. French, 1903: 1916).—Southeast of Bridal Veil, a town on the Columbia River, on the highest peak of Larch Mountain and on the west point of a small rock ledge which is on the north end of a spur from the main summit. The ledge is about 20 feet higher than

For notes in regard to marking of stations see p. 23.

the spur of which it forms the end, and descends abruptly on the north in a cliff about 100 feet high. It can be reached either from Bridal Veil or Latourell via Donahue's logging camp. The station is marked according to note 1. Two reference marks, described in note 4, are in the east summit of the ledge, one in rather a low place 10.89 meters from the station in azimuth $298^{\circ} 51'$, and the other near the east end of the summit 15.01 meters from the station in azimuth $287^{\circ} 02'$.

Star (Clark County, Wash., J. S. Hill, 1906; 1916).—On the most southerly of the two summits of Silver Star Mountain, on the line between Clark and Skamania Counties, about 35 miles northeast of Vancouver. The station was marked according to note 3. Two reference marks, described in note 4 are at the following distances and azimuths from the station: 5.910 meters, $305^{\circ} 43'$; and 5.160 meters, $26^{\circ} 11'$.

Davis (Cowlitz County, Wash., J. S. Hill, 1906).—About 14 miles northeast of Woodland on the highest point of a hill on a north-and-south ridge which may be reached from Woodland by following the road up the Lewis River to the Fisher place and packing from there. The station is marked according to note 3. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 5.61 meters, $15^{\circ} 02'$; and 5.37 meters, $96^{\circ} 51'$.

Red (Skamania County, Wash., J. S. Hill, 1906).—On the highest point of a bald, red hill near the sources of the Little White Salmon and Lewis Rivers and not far from Klickitat Pass. It is best reached from White Salmon on the Columbia River via Guler post office, Ice Cave, Peterson's prairie, Goose Lake, Steamboat Lake, and the Indian race track, being about 1 mile southwest from the last place and $1\frac{1}{2}$ miles west of Steamboat Lake. There is a Forest Service lookout station with its south wall about 2 meters north of the station mark. The station is marked according to note 3. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 7.400 meters, $96^{\circ} 14'$; and 5.422 meters, $188^{\circ} 46'$.

Warren (Columbia County, Oreg., O. B. French, 1903).—About a mile southwest of Warren, a station on the Northern Pacific Railway, on a slight elevation or ridge near the west side of a pasture owned by Mr. E. Harnes and about 250 meters north of an east-and-west road. The station is marked according to note 2, the surface mark in a bowlder 8 by 24 by 24 inches with the letters "U. S." cut in the north side and the subsurface mark in a stone 6 by 12 by 18 inches buried 18 inches below the ground. Three reference marks, described in note 4, are in the north-and-south fence line to the west of the station. The middle reference mark of the three is 246.7 meters north of the north road fence and the other two are each about 30 meters distant from the middle mark, one north and the other south. They are at the following distances and azimuths from the station: 23.67 meters, $93^{\circ} 15'$; 37.46 meters, $41^{\circ} 26'$; and 37.95 meters, $142^{\circ} 46'$.

Lam (Cowlitz County, Wash., J. S. Hill, 1906).—On the highest part of the heavily wooded summit of Elk Mountain, about 35 miles northeast of Woodland. The station is marked according to note 3. Two reference marks, described in note 4 are at the following distances and azimuths from the station: 6.23 meters, $36^{\circ} 56'$; and 10.84 meters, $319^{\circ} 02'$.

Len (Skamania County, Wash., J. S. Hill, 1906).—In the northwestern part of Skamania County, about 10 miles north of Mount St. Helens and a short distance northeast of Spirit Lake. Spirit Lake can be reached by stage road from Castle Rock via Toutle and St. Helens, and from the south landing on this lake the peak on which the station is located appears as a rocky summit through a gap almost due north. The station is marked according to note 3. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 3.290 meters, $215^{\circ} 15'$; and 12.220 meters, $138^{\circ} 04'$.

Toutle (Cowlitz County, Wash., O. B. French, 1905).—On the top of a conical hill, the highest point of a long ridge, known locally as Gum Mountain, between the north and south forks of the Toutle River and about 20 miles east of Castle Rock. The summit was heavily timbered in 1905 and lines of sight were cleared. The station is reached from Castle Rock via Toutle and St. Helens and the main road left at a point about $2\frac{1}{2}$ miles east of St. Helens at Muniker's place, from where the station is about 3 miles distant in a southerly direction. The station is marked according to note 2, the underground mark in a stone 12 inches in diameter 2 feet below the ground and the surface

For notes in regard to marking of stations see p. 23.

mark in a boulder 12 by 18 by 24 inches. The reference marks are copper bolts set in the center of triangular blazes on each of three stumps on the sides facing the station, the first being 0.24 meters from the station in azimuth $104^{\circ} 22'$, the second 9.18 meters, in azimuth $165^{\circ} 16'$, and the third 7.90 meters, in azimuth $345^{\circ} 34'$. Two blazed trees are at the following distances and azimuths from the station: 16.24 meters, $152^{\circ} 52'$; and 26.44 meters, $257^{\circ} 50'$.

Huck (Lewis County, Wash., O. B. French, 1905).—On a high, bald summit, known locally as Huckleberry Mountain, and about 8 miles northwest of the highest point of the Deschutes Mountains in this region. The station is on a level place on the summit and about 60 feet north of a sharp rocky point of about the same height. The station is marked by a one-half inch drill hole 1 inch deep in the top of a boulder 8 by 8 by 10 inches set flush with the surface of the ground. The reference marks, three in number, are similar drill holes in solid ledges along the west side of the ridge a little below its top, and at the following distances and azimuths from the station: 13.65 meters, 40° ; 7.30 meters, 60° ; and 5.60 meters, 136° .

Bel (Pierce County, Wash., O. B. French, 1905).—On a high rocky peak known as "Bel Jacket," about 10 or 12 miles a little south of west of Mount Rainier, and about $9\frac{1}{2}$ miles by road from Ashford. From Ashford there is a wagon road leading to Messler's place about 5 miles distant, then a trail in the direction of Bald Rock and Eagle Rock, which leads to a small lake from where the peak may be seen about one-half mile distant a little to the west of north. The station is marked according to note 3. Three reference marks, described in note 4, are at the following distances and azimuths from the station: 7.26 meters, $328^{\circ} 46'$; 5.24 meters, $16^{\circ} 22'$; and 5.94 meters, $188^{\circ} 29'$. A drill hole is 16.89 meters from the station in azimuth $15^{\circ} 01'$.

Hal (Lewis County, Wash., O. B. French, 1905).—On the highest point of the most western one of the high, bald summits of the Deschutes Mountains near the northern line of Lewis County and due south of Tacoma. From the north the mountain appears as a symmetrical cone and is best approached from Yelm, a town on the Northern Pacific Railway, via Peter Stone's ranch, which is about 14 miles southeast of Yelm and a short distance north of the station. The station is near the south point of the hilltop and marked according to note 3. Three reference marks, described in note 4, are located as follows: The first in a large boulder, 10.55 meters from the station in azimuth $166^{\circ} 24'$, the second in a broad sloping ledge 4.81 meters distant in azimuth $338^{\circ} 35'$, and the third in about the highest point of rocks 2.71 meters distant in azimuth $18^{\circ} 07'$.

Rain (Thurston County, Wash., O. B. French, 1905).—About 10 meters northwest of the highest point of a prominent high hill about 4 miles south-southeast of the town of Rainier, about 1,200 feet above it, and just visible over the top of the timber from the town. It is probably in sec. 33, T. 16, R. 1 E., and it is about a mile west-northwest of the ranch on the top of the ridge owned by N. N. Bungard. The station is marked according to note 2, the subsurface mark in a boulder about 10 by 12 by 12 inches and 15 inches below the surface of the ground, and the surface mark in a boulder 12 by 20 by 20 inches. Two reference marks, described in note 4, are located as follows: One in a large boulder at the highest part of the hill, 8.75 meters from the station in azimuth $8^{\circ} 54'$, and the other in a boulder at some distance down the slope of the hill and 13.78 meters from the station in azimuth $218^{\circ} 42'$.

Hurst (Pierce County, Wash., O. B. French, 1905).—Near the north end and highest part of the timbered hill about 400 meters slightly south of west from the railroad station at Hillhurst, a town on the Northern Pacific Railway, and about one-half mile southwest of the store and post office. The hill is across the road south from the Cottage Grove Farm, owned by Mr. Bucholtz. The station is marked at the surface with an old-type station mark, described on page 23, set in a concrete block 12 inches square and 18 inches deep, and underground by a one-half inch copper bolt 4 inches long set in the solid ground or native cement 3 feet beneath the surface. There are two reference marks, one of which is a copper bolt set in the only large rock in the neighborhood, 40.34 meters from the station in azimuth $252^{\circ} 40'$, and the other is a similar copper bolt in a boulder 10 by 12 by 12 inches flush with the surface of the ground, with a smaller boulder 8 by 10 by 10 inches directly below it, and is 13.52 meters from the station in azimuth $150^{\circ} 41'$.

For notes in regard to marking of stations see p. 23.

Pen (Pierce County, Wash., O. B. French, 1905).—About one-half mile south of Graham, a station on the Tacoma Eastern Railroad, about one-half mile northwest of Mr. Hansen's house, and 75 or 100 meters to the westward of the highest part of a flat, partly cleared summit. The station is marked according to note 2. Three reference marks, described in note 4, are at the following distances and azimuths from the station: 18.93 meters, $242^{\circ} 50'$; 17.80 meters, $87^{\circ} 58'$; and 23.15 meters, $160^{\circ} 53'$.

Tacoma south base (Pierce County, Wash., O. B. French, 1905).—About 10 miles south of Tacoma and 2 miles south of Spanaway Lake, on land belonging to William Sekor, in the prolongation of Pacific Avenue of Tacoma. From the top of the hill in South Tacoma this street is nearly a straight line and Tacoma base line lies along it. The station is on the highest bench near the south side of Sekor's property and near the highest point of the bench, being about 10 feet west of a small but prominent knoll. It is 178.5 meters from the fence on the south side of the field and 154.8 meters from the fence on the west side. The station is marked underground by a cross in the head of a one-half inch copper bolt 3 inches long set in a block of concrete $2\frac{1}{2}$ feet square and 6 inches thick 3 feet beneath the surface, and at the surface by an old-type station mark, described on page 23, set in the top of a concrete cube $2\frac{1}{2}$ feet on an edge which has a 4-inch drain tile 2 feet long at the center with its top flush with the surface of the concrete. There are three reference marks, each consisting of a copper bolt set in a concrete block 18 inches square and 6 inches thick buried 3 feet below the surface, and of a similar bolt above it in a concrete block 18 inches square and 30 inches deep, its top 2 inches below the surface of the ground. They are at the following distances and azimuths from the station: 49.653 meters, $263^{\circ} 50'$; 38.938 meters, $347^{\circ} 25'$; and 61.153 meters, $173^{\circ} 25'$.

Tacoma north base (Pierce County, Wash., O. B. French, 1905).—On Fern Hill, 4 miles south of Tacoma and about one-fourth mile north of the crossing of Pacific Avenue and the Puyallup Electric Railway. It is on a prominent knoll just south of the house owned and occupied by H. A. Wilhelm, 8.5 meters south of his south line and 19 meters east of the east line of Pacific Avenue. The subsurface mark at the station is a cross in the head of a one-half inch copper bolt 3 inches long set in a block of concrete 30 by 30 inches and 6 inches thick, 3 feet beneath the surface. The surface mark is an old-type station mark, described on page 23, set in a concrete cube $2\frac{1}{2}$ feet on an edge which has a 4-inch drain tile 2 feet long at the center with its top flush with the surface of the concrete. There are three reference marks, each consisting of a one-eighth inch copper wire embedded in an underground block of concrete 14 by 14 inches and 6 inches thick set 3 feet below the surface, and of a surface mark consisting of a similar wire in a block 14 by 14 by 30 inches set with the top flush with the surface of the ground. They are located as follows: The first, just north of Dr. Rynning's north fence and 4 feet east of the east line of Pacific Avenue, 92.325 meters from the station in azimuth $10^{\circ} 19'$; the second, south of the back part of Wilhelm's house and just south of his south fence, 47.757 meters from the station in azimuth $259^{\circ} 51'$; and the third just south of Wilhelm's south fence and 2 feet east of the east line of Pacific Avenue, 19.672 meters from the station in azimuth $117^{\circ} 04'$.

Burn (Pierce County, Wash., O. B. French, 1905; 1919).—On a prominent ridge 2 or 3 miles southwest of the central part of the city of Tacoma, in a section of the city called Oakland, west of that part of the valley which is traversed by the Northern Pacific Railway in an east-and-west direction and almost in line with the east-and-west portion of the track, about three-fourths of a mile from its western end. It is on a summit about one-half mile west of a prominent schoolhouse, about 300 meters southeast of a house, and about 30 meters north of a private road leading from the house to the schoolhouse, which road is a continuation of Proctor Street. The station can be reached by the American Lake south car to Proctor Street. The station is marked according to note 2, with the subsurface boulder about 2 feet below the surface. Three reference marks, described in note 4, are located as follows: The first near a trail along the ridge and 23.53 meters from the station, in azimuth $160^{\circ} 44'$; the second on the north edge of the road 25.13 meters distant, in azimuth $320^{\circ} 00'$; and the third near the beginning of a slope 25.47 meters distant, in azimuth $85^{\circ} 34'$.

Kin (Pierce County, Wash., O. B. French, 1905).—On the top of a prominent hill in the southeastern part of Tacoma, just south of McKinley Park, in the

For notes in regard to marking of stations see p. 23.

block between Thirty-second Street and Wright Avenue and K and L Streets and very nearly halfway between Thirty-second Street and Wright Avenue. It is directly in line with the gable ends of the N. P. B. A. Hospital, a large brick building a couple of hundred yards to the westward of the station. The station is marked according to note 2. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 24.55 meters, $215^{\circ} 48'$; and 18.47 meters, $294^{\circ} 50'$. This station has probably been lost, due to local improvements.

Wash (Pierce County, Wash., O. B. French, 1905).—*Lost*.

Bos (Pierce County, Wash., O. B. French, 1905; 1919).—In the flat about 2 miles east of Tacoma and one-third of a mile south of the trestle leading from the city across the marsh to the mills on the east side of the valley. It is about 75 meters northeast of a small white house at the north end of the strip of fast land which extends farthest into the marsh and on a very slight elevation, clear of trees and buildings, on the edge of a slough. The station is marked according to note 2, the lower mark in a small bowlder 15 inches below the surface and the upper mark in a bowlder about 10 inches in diameter projecting 3 inches above the surface of the ground. There are no reference marks, but a broken-topped fir tree is about 60 meters from the station, in azimuth $331^{\circ} 44'$, and the west corner of the small white house is 77.72 meters distant, in azimuth $13^{\circ} 54'$.

Gull (Pierce County, Wash., J. J. Gilbert, 1891; 1921).—On Commencement Bay, north of Tacoma, and about 1 mile southeast from Brown Point Lighthouse, on the bold bluff about 125 feet high, which is conspicuous on approaching the point from Tacoma. The station is about 15 feet from the edge of the bluff and in range with the tower of the Lowell School in Tacoma and the left tangent of the tall, dark, cylindrical building with a dome roof, which belongs to the Tacoma Lumber Co.'s mill, and bears about southwest from the station. The station is marked by a standard bronze tablet set in concrete and stamped on the face "Gull 1921," and the underground mark is a bottle buried $2\frac{1}{2}$ feet below the surface. There is a standard bronze reference mark set in a concrete post 7.847 meters from the station in azimuth $255^{\circ} 03'$.

Dron (Pierce County, Wash., O. B. French, 1905; 1921).—On Commencement Bay, about one-half mile southeast of Brown Point Lighthouse and about one-half mile west of station *Gull*. It is on the highest part of a bluff point about 60 feet above the water and 20 or 25 feet inland from the edge of the bluff, in a thicket of madrona trees, some of which were felled to clear the line to station *Neill*. The station is marked by a standard bronze station mark set in a mass of concrete and stamped on the face "Dron 1921," and the underground mark is a cross in the top of a copper bolt set in a bowlder. There is a standard bronze reference mark set in a rock 4.42 meters from the station in azimuth $175^{\circ} 08'$.

Smelt (Pierce County, Wash., O. B. French, 1905; 1921).—On a ridge in the extreme northwestern part of Tacoma just south of Point Defiance Park. To reach the station take the Point Defiance Park car to North Forty-ninth Street, walk about 5 blocks west and climb the hill at the end of the street, the station is on the projection of North Forty-ninth Street, not far from the west edge of the main ridge, considerably below the highest point, and at about the same elevation as the small knoll some 300 feet west of the station. The station is marked as described in note 2, except that the top of the mark has been torn away leaving only the shank in the concrete. The reference mark is a copper slug set in a stone in place 53.16 meters from the station in azimuth $236^{\circ} 33'$.

Neill 2 (Pierce County, Wash., O. B. French, 1905).—*Lost*.

Tacoma astronomic station (Pierce County, Wash., J. F. Pratt, 1892; 1905).—A stone pier near the north end of Wrights Park, Tacoma. A brick pier 17 inches square and $5\frac{1}{4}$ feet long, used for latitude observations in 1894, is 12 feet 3 inches due east of the station.

SUPPLEMENTARY POINTS.

Corning tower (Tehama County, Calif., O. B. French, 1904).—The tower at the south end of the Maywood Colonization Building, a wood and plaster structure, just across the street from the Maywood Hotel and southwest from the railroad station.

For notes in regard to marking of stations see p. 23.

Corning astronomic station (Tehama County, Calif., W. H. Burger, 1908).—On the vacant lot just west of the Maywood Colonization Building at Corning. (See Corning tower, above.) The station is not marked but the following distances and azimuths to different parts of the Maywood Colonization Building were measured. Tower, 23.40 meters, $247^{\circ} 24' 2''$; northwest corner of the porchlike part of the building known as the Arcade, 31.40 meters, $207^{\circ} 55' 2''$; and southwest corner of the same Arcade, 16.64 meters, $242^{\circ} 17' 8''$.

Redding courthouse (Shasta County, Calif., O. B. French, 1904; 1908).—The center of the top of the dome of the courthouse upon which stands the statue of justice. The statue is eccentric to the center of the dome by about $1\frac{1}{2}$ feet. A triangle with a small hole at the center is cut in the floor of the dome directly below the center of the dome and may be used as the station.

Redding astronomic station (Shasta County, Calif., O. B. French, 1904; 1908).—On a prominent hill about three-fourths of a mile south by west from the railroad station at Redding. To reach the station follow the railroad track south to milepost 259, which is marked at present by a board nailed to a telegraph pole, where will be found a United States Geological Survey bench mark, a metal tube with a brass top, and from here the station is west about one-fourth of a mile. The station is on the brow of a hill somewhat toward the south edge and not quite at the highest point. A live oak about 6 inches in diameter is on the edge of the hill just north of the line to the Geological Survey bench mark and a leaning pine tree about a quarter of a mile distant is in line with the Redding courthouse. The station is marked according to note 1, in the top of a large boulder projecting 4 inches above the ground. Two reference marks, described in note 4, are at the following distances and azimuths from the station: 20.22 meters, $115^{\circ} 49'$; and 9.99 meters, $188^{\circ} 17'$.

Redding south base (Shasta County, Calif., W. H. Burger, 1908).—About 15 feet east of the railroad track at Redding and opposite a large steel oil tank. The station is marked only by a nail in the top of a wooden stub and by the three instrument stubs.

Redding north base (Shasta County, Calif., W. H. Burger, 1908).—Near the northwest corner of the cemetery south of the railroad station at Redding and about 15 feet east of the track. The station is marked only by a nail in a wooden stub and by the three instrument stubs around it.

Hill (Shasta County, Calif., W. H. Burger, 1908).—On the east brow of a ridge just north of the ridge on which *Redding astronomic station* is located (see above), and almost on the line between that station and the courthouse at Redding. The station is marked only by a wooden stub and the three instrument stubs surrounding it.

Central Point astronomic station (Jackson County, Oreg., O. B. French, 1904; 1908).—About 2 miles north of Central Point, near the intersection of the Southern Pacific Railway and the county road and in the northwest corner of the field which is just east of the county road and south of the private road leading to the house occupied by George Mims. The station is about 30 meters from the railroad. (See *Central Point latitude station*, below). The underground mark at the station is a three-fourths inch drill hole in the top of a triangular granite rock, set in cement 15 inches below the surface of the ground. The surface mark is an old-type station mark, described on page 23, set in the top of a granite rock which projects 2 inches above the surface and which is embedded in a mass of concrete 30 inches square and 12 inches deep. The reference mark, a United States Geological Survey bench mark, is at the intersection of the railroad and the county road, just east of the rail on the east side of the road and 28.15 meters from the station in azimuth $31^{\circ} 55'$.

Central Point latitude station (Jackson County, Oreg., W. H. Burger, 1908).—Near *Central Point astronomic station* (see above) and marked only by a wooden pier. The following distances and azimuths were measured: Astronomic station, 4.77 meters, $116^{\circ} 41'$; United States Geological Survey bench mark (reference mark of astronomic station), 28.82 meters, $41^{\circ} 18'$. The north and west fences of the field are, respectively, 6.18 meters and 15.55 meters from the station.

Rose (Douglas County, Oreg., O. B. French, 1904).—On the highest point of the highest bald summit of a ridge about $1\frac{1}{2}$ miles north of Roseburg. The station is marked according to note 2, the underground mark in a mass of concrete 1 foot below the surface and the surface mark in a boulder 9 by 14 by 18 inches flush with the surface of the ground. Two reference marks, described in note

For notes in regard to marking of stations see p. 23.

4, are at the following distances and azimuths from the station: 16.71 meters, $12^{\circ} 24'$; and 7.49 meters, $125^{\circ} 23'$.

Burg (Douglas County, Oreg., O. B. French, 1904).—On a high, bald summit about 3 miles southeast of Roseburg. As seen from the iron bridge over the river just west of the railroad station, it is the highest and most distant peak visible up a small valley. The station is marked according to note 2, the underground mark in a mass of concrete 18 inches below the surface, and the surface mark in a bowlder 10 by 12 by 14 inches set flush with the surface of the ground. The reference mark, described in note 4, is in a bowlder just over the edge of the hill, 10.24 meters from the station in azimuth $112^{\circ} 45'$.

Roseburg latitude station (Douglas County, Oreg., O. B. French, 1904).—On the point of a spur across the river from the town of Roseburg, about 100 feet west from the end of the bridge and 60 feet above it. The station is marked according to note 1, set in a ledge of rock. Two reference marks, described in note 4, are located as follows: One in a prominent ledge 18.18 meters from the station in azimuth $80^{\circ} 17'$, and the other in the side of a ledge flush with the ground, 32.80 meters from the station in azimuth $109^{\circ} 05'$.

Springfield Methodist Church (Lane County, Oreg., W. H. Burger, 1908).—The lower and less prominent of the two churches at Springfield.

Springfield Christian Church (Lane County, Oreg., W. H. Burger, 1908).—The taller and more prominent of the two churches at Springfield.

Deady Hall, west tower (Lane County, Oreg., W. H. Burger, 1908).—Deady Hall is one of the two larger buildings of the University of Oregon at Eugene and has large square towers at both the east and west ends.

Geary School spire, Eugene (Lane County, Oreg., W. H. Burger, 1908).—The Geary School is the public school located at West Fourth and Madison Streets, Eugene.

United Brethren Church spire, Eugene (Lane County, Oreg., W. H. Burger, 1908).—At East Eleventh and Ferry Streets, Eugene.

Patterson School spire, Eugene (Lane County, Oreg., W. H. Burger, 1908).—The public school located one block west of the southwest corner of the campus of the University of Oregon, at Eugene.

Baptist Church spire, Eugene (Lane County, Oreg., W. H. Burger, 1908).—At East Eighth and Pearl Streets, Eugene.

W. O. W. Hall spire, Eugene (Lane County, Oreg., W. H. Burger, 1908).—The old Episcopal Church located at West Eighth and Lincoln Streets, Eugene, which is now being used as a hall by the Woodmen of the World.

Courthouse flagpole (Lane County, Oreg., W. H. Burger, 1908).—At East Eighth and Oak Streets, Eugene.

Methodist Church spire (Lane County, Oreg., W. H. Burger, 1908).—The Humphrey Memorial M. E. Church located at West Tenth and Willamette Streets, Eugene.

Seavies (U. S. G. S.) (Lane County, Oreg., O. B. French, 1904).—This station is identical with the United States Geological Survey station of the same name. It is on the most southern of the high hills, about 6 miles northeast of Eugene and about 30 or 40 feet southwest of and slightly lower than the highest part of the hill. The station is marked by a square stone 4 by 4 by 24 inches with its top a little below the surface. The old Geological Survey signal was still standing in 1904, anchored in place by rocks, and was not disturbed.

Monument, General Land Survey (Multnomah County, Oreg., O. B. French, 1903).—The initial intersection of the First Standard Parallel and the Willamette Meridian, a short distance southeast of *Barnes*. (See p. 29.) The station is in a fence corner and is marked by a stone post projecting $1\frac{1}{2}$ feet above the ground.

River (Multnomah County, Oreg., O. B. French, 1903).—Near the junction of the two suburbs of Portland known as Arbor Lodge and Peninsula, on the east bank of the Willamette River about a mile east of Columbia University. It is on a slight elevation, the highest in the vicinity, and in the fence line on the north side of the boulevard along the river bank. It was placed as far east as possible and still keep the Oregonian Building in view. The station is marked by crosses cut in the tops of two bowlders, one placed near the surface of the ground and the other directly beneath at a depth of 1.7 feet, each stone bearing the letters "U. S. C. S." cut in the top.

For notes in regard to marking of stations see p. 23.

Oregonian (Multnomah County, Oreg., O. B. French, 1903).—The tall iron pole at the southeast corner of the tower of the Oregonian Building, at the northwest corner of Sixth and Adler Streets, Portland.

Portland longitude station (Multnomah County, Oreg., C. H. Sinclair, 1887; 1905).—This station has been destroyed.

Portland latitude station (Multnomah County, Oreg., C. H. Sinclair, 1887; 1905).—This station has been destroyed.

Rocky Butte (Multnomah County, Oreg., C. Rockwell, 1889; 1903).—On the north side of the highest part of the brush-covered summit of the butte, about 2 miles northeast of Montavilla. The station is marked by a hole drilled in a large round-topped boulder.

Harney (Clarke County, Wash., C. Rockwell, 1881; 1903).—On the north bank of the Columbia River, about $1\frac{1}{2}$ miles above the United States wharf at Vancouver, on the sloping bare bluff immediately above the road leading from Vancouver up the river. It is almost in front of the "Harney House," on land formerly owned by Gen. Harney, and about 80 meters east of the fence inclosing the race track. The underground mark consists of a glass bottle placed 3 feet below the surface, with the neck up, the center of the neck marking the station, and three other bottles placed on their sides at a depth of about 1 foot and at distances of about 6 feet from the center, with the necks of the bottles pointing toward the center. The surface mark is a small drill hole 2 inches deep in a basaltic boulder, weighing about 350 pounds, placed with its top flush with the surface of the ground. The following bearings to the right of magnetic north were read at the station: East chimney of Harney House, $27^{\circ} 05'$; triangle on tree, $74^{\circ} 28'$; white house on south side of river, $172^{\circ} 55'$; ventilator on barn, $220^{\circ} 06'$; and corner of race track fence, $276^{\circ} 47'$.

Balch (Multnomah County, Oreg., C. Rockwell, 1881; 1906).—This station was occupied for azimuth in 1886. It is immediately northwest of the city limits of Portland, about a mile south of the Willamette River, on the first small level bench of the spur making out from the ridge west of the Cornell road, and about 255 feet above the road. The station is marked underground by a broken-necked bottle placed neck up 2 feet below the surface, and by a cross in the top of a copper bolt set in concrete 6 inches above the bottle, and at the surface by a cross on an old-type station mark described on page 23, set in concrete, which is inscribed with the letters "C. & G. S." The reference marks are the remains of two brick piers built in line to the west of the station, with their foundation about 20 inches below the surface, the nearest edge of the first pier being about 1 meter west of the station.

Dash (Pierce County, Wash., G. Davidson, 1857; 1905).—Lost.

Piner 2 (King County, Wash., O. B. French, 1905; 1913).—On the southeast point of Maury Island, about 25 feet above high tide and 90 or 40 feet inland from high-water mark. A group of four piles is 30 or 40 meters east of the station, and a large rock, the largest in the vicinity, is in the water 50 or 60 meters south and a little west from the station. The station is marked by a three-fourths inch drill hole in a large stone set flush with the surface, and underground by a similar drill hole in a stone 2 feet below the surface of the ground. Two reference marks, each consisting of surface and subsurface stones, are at the following distances and azimuths from the station: 4.61 meters, $86^{\circ} 55'$; and 4.65 meters, $167^{\circ} 45'$. This station could not be found in 1919 and the evidence seemed to be that it had slid over the bank.

Robinson 2 (King County, Wash., J. S. Lawson, 1887; 1919).—On Robinson Point, on Maury Island, about 300 meters southwest of the scaffold light, on a bluff about 20 feet above high tide and 30 feet inland from high-water mark. The station is 95 meters southwest of the light keeper's dwelling, 42 meters southwest from the southeast corner of the light keeper's shed or barn, and about 2 meters west of the fence which extends southwest from the corner of the shed. A large madrona tree at the top of the bluff is 15 or 20 meters southwest of the station. The station is marked underground by a one-half inch drill hole in a stone buried 1 foot deep and at the surface by a similar hole in a stone, directly above the lower mark, set with its top flush with the surface of the ground. One reference mark is a one-half inch drill hole in a solid stone which is in line with the fence running southwest from the shed, and is 2.93 meters from the station in azimuth $26^{\circ} 25'$. The other reference mark consists of surface and subsurface stones, the lower one $1\frac{1}{2}$ feet beneath the surface, and is 10.62 meters from the station in azimuth $185^{\circ} 06'$.

For notes in regard to marking of stations see p. 23.

CONVERSION TABLES.

Lengths—Feet to meters (from 1 to 1000 units).

[Reduction factor: 1 foot=0.3048006096 meter.]

Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.
0	0.0	50	15.24003	100	30.48006	150	45.72009	200	60.96012
1	0.30480	1	15.54483	1	30.78486	1	46.02489	1	61.26492
2	0.60960	2	15.84963	2	31.08966	2	46.32969	2	61.56972
3	0.91440	3	16.15443	3	31.39446	3	46.63449	3	61.87452
4	1.21920	4	16.45923	4	31.69926	4	46.93929	4	62.17932
5	1.52400	5	16.76403	5	32.00406	5	47.24409	5	62.48412
6	1.82880	6	17.06883	6	32.30886	6	47.54890	6	62.78892
7	2.13360	7	17.37363	7	32.61366	7	47.85370	7	63.09372
8	2.43840	8	17.67843	8	32.91846	8	48.15850	8	63.39852
9	2.74321	9	17.98324	9	33.22327	9	48.46330	9	63.70332
10	3.04801	60	18.28804	110	33.52807	160	48.76810	210	64.00812
1	3.35281	1	18.59284	1	33.83287	1	49.07290	1	64.31292
2	3.65761	2	18.89764	2	34.13767	2	49.37770	2	64.61772
3	3.96241	3	19.20244	3	34.44247	3	49.68250	3	64.92252
4	4.26721	4	19.50724	4	34.74727	4	49.98730	4	65.22732
5	4.57201	5	19.81204	5	35.05207	5	50.29210	5	65.53212
6	4.87681	6	20.11684	6	35.35687	6	50.59690	6	65.83692
7	5.18161	7	20.42164	7	35.66167	7	50.90170	7	66.14172
8	5.48641	8	20.72644	8	35.96647	8	51.20650	8	66.44652
9	5.79121	9	21.03124	9	36.27127	9	51.51130	9	66.75132
20	6.09601	70	21.33604	120	36.57607	170	51.81610	220	67.05612
1	6.40081	1	21.64084	1	36.88087	1	52.12090	1	67.36092
2	6.70561	2	21.94564	2	37.18567	2	52.42570	2	67.66572
3	7.01041	3	22.25044	3	37.49047	3	52.73050	3	67.97052
4	7.31521	4	22.55525	4	37.79528	4	53.03531	4	68.27532
5	7.62002	5	22.86005	5	38.10006	5	53.34011	5	68.58012
6	7.92482	6	23.16485	6	38.40486	6	53.64491	6	68.88492
7	8.22962	7	23.46965	7	38.70966	7	53.94971	7	69.18972
8	8.53442	8	23.77445	8	39.01446	8	54.25451	8	69.49452
9	8.83922	9	24.07925	9	39.31926	9	54.55931	9	69.79932
30	9.14402	80	24.38405	130	39.62406	180	54.86411	230	70.10412
1	9.44882	1	24.68885	1	39.92886	1	55.16891	1	70.40892
2	9.75362	2	24.99365	2	40.23366	2	55.47371	2	70.71372
3	10.05842	3	25.29845	3	40.53846	3	55.77851	3	71.01852
4	10.36322	4	25.60325	4	40.84326	4	56.08331	4	71.32332
5	10.66802	5	25.90805	5	41.14806	5	56.38811	5	71.62812
6	10.97282	6	26.21285	6	41.45286	6	56.69291	6	71.93292
7	11.27762	7	26.51765	7	41.75766	7	56.99771	7	72.23772
8	11.58242	8	26.82245	8	42.06246	8	57.30251	8	72.54252
9	11.88722	9	27.12725	9	42.36726	9	57.60731	9	72.84732
40	12.19202	90	27.43205	140	42.67206	190	57.91211	240	73.15212
1	12.49682	1	27.73685	1	42.97686	1	58.21691	1	73.45692
2	12.80163	2	28.04166	2	43.28166	2	58.52171	2	73.76172
3	13.10643	3	28.34646	3	43.58646	3	58.82652	3	74.06652
4	13.41123	4	28.65126	4	43.89126	4	59.13132	4	74.37132
5	13.71603	5	28.95606	5	44.19606	5	59.43612	5	74.67612
6	14.02083	6	29.26086	6	44.50086	6	59.74092	6	74.98092
7	14.32563	7	29.56566	7	44.80566	7	60.04572	7	75.28572
8	14.63043	8	29.87046	8	45.11046	8	60.35052	8	75.59052
9	14.93523	9	30.17526	9	45.41526	9	60.65532	9	75.89532

Lengths—Feet to meters (from 1 to 1000 units)—Continued.

Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.
250	76.20015	300	91.44018	350	106.68021	400	121.92024	450	137.16027
1	76.50495	1	91.74498	1	106.98501	1	122.22504	1	137.46507
2	77.00975	2	92.04978	2	107.28981	2	122.52984	2	137.76987
3	77.11455	3	92.35458	3	107.59462	3	122.83465	3	138.07468
4	77.41935	4	92.65938	4	107.89942	4	123.13945	4	138.37948
5	77.72415	5	92.96419	5	108.20422	5	123.44425	5	138.68428
6	78.02895	6	93.26899	6	108.50902	6	123.74905	6	138.98908
7	78.33375	7	93.57379	7	108.81382	7	124.05385	7	139.29388
8	78.63855	8	93.87859	8	109.11862	8	124.35865	8	139.59868
9	78.94335	9	94.18339	9	109.42342	9	124.66345	9	139.90348
260	79.24815	310	94.48819	360	109.72822	410	124.96825	460	140.20828
1	79.55295	1	94.79299	1	110.03302	1	125.27305	1	140.51308
2	79.85775	2	95.09779	2	110.33782	2	125.57785	2	140.81788
3	80.16255	3	95.40259	3	110.64262	3	125.88265	3	141.12268
4	80.46735	4	95.70739	4	110.94742	4	126.18745	4	141.42748
5	80.77215	5	96.01219	5	111.25222	5	126.49225	5	141.73228
6	81.07695	6	96.31699	6	111.55702	6	126.79705	6	142.03708
7	81.38175	7	96.62179	7	111.86182	7	127.10185	7	142.34188
8	81.68655	8	96.92659	8	112.16662	8	127.40665	8	142.64668
9	81.99135	9	97.23139	9	112.47142	9	127.71145	9	142.95148
270	82.29615	320	97.53620	370	112.77622	420	128.01625	470	143.25628
1	82.60095	1	97.84100	1	113.08102	1	128.32105	1	143.56108
2	82.90575	2	98.14580	2	113.38582	2	128.62585	2	143.86588
3	83.21055	3	98.45060	3	113.69062	3	128.93065	3	144.17068
4	83.51535	4	98.75540	4	113.99542	4	129.23545	4	144.47548
5	83.82015	5	99.06020	5	114.30022	5	129.54025	5	144.78028
6	84.12495	6	99.36500	6	114.60502	6	129.84505	6	145.08508
7	84.42975	7	99.66980	7	114.90982	7	130.14985	7	145.38988
8	84.73455	8	99.97460	8	115.21462	8	130.45465	8	145.69468
9	85.03935	9	100.27940	9	115.51942	9	130.75945	9	145.99948
280	85.34415	330	100.58420	380	115.82422	430	131.06425	480	146.30428
1	85.64895	1	100.88900	1	116.12902	1	131.36905	1	146.60908
2	85.95375	2	101.19380	2	116.43382	2	131.67385	2	146.91388
3	86.25855	3	101.49860	3	116.73862	3	131.97865	3	147.21868
4	86.56335	4	101.80340	4	117.04342	4	132.28345	4	147.52348
5	86.86815	5	102.10820	5	117.34822	5	132.58825	5	147.82828
6	87.17295	6	102.41300	6	117.65302	6	132.89305	6	148.13308
7	87.47775	7	102.71780	7	117.95782	7	133.19785	7	148.43788
8	87.78255	8	103.02260	8	118.26262	8	133.50265	8	148.74268
9	88.08735	9	103.32740	9	118.56742	9	133.80745	9	149.04748
290	88.39215	340	103.63220	390	118.87222	440	134.11225	490	149.35228
1	88.69695	1	103.93700	1	119.17702	1	134.41705	1	149.65708
2	89.00175	2	104.24180	2	119.48182	2	134.72185	2	149.96188
3	89.30655	3	104.54660	3	119.78662	3	135.02665	3	150.26668
4	89.61135	4	104.85140	4	120.09142	4	135.33145	4	150.57148
5	89.91615	5	105.15620	5	120.39622	5	135.63625	5	150.87628
6	90.22095	6	105.46100	6	120.70102	6	135.94105	6	151.18108
7	90.52575	7	105.76580	7	121.00582	7	136.24585	7	151.48588
8	90.83055	8	106.07060	8	121.31062	8	136.55065	8	151.79068
9	91.13535	9	106.37540	9	121.61542	9	136.85545	9	152.09548

Lengths—Feet to meters (from 1 to 1000 units)—Continued.

Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.
500	152.40030	560	167.64034	600	182.89037	650	198.12040	700	213.36043
1	152.70511	1	167.94514	1	183.18517	1	198.42520	1	213.66523
2	153.00991	2	168.24994	2	183.48997	2	198.73000	2	213.97003
3	153.31471	3	168.55474	3	183.79477	3	199.03480	3	214.27483
4	153.61951	4	168.85954	4	184.09957	4	199.33960	4	214.57963
5	153.92431	5	169.16434	5	184.40437	5	199.64440	5	214.88443
6	154.22911	6	169.46914	6	184.70917	6	199.94920	6	215.18923
7	154.53391	7	169.77394	7	185.01397	7	200.25400	7	215.49403
8	154.83871	8	170.07874	8	185.31877	8	200.55880	8	215.79883
9	155.14351	9	170.38354	9	185.62357	9	200.86360	9	216.10363
510	155.44831	560	170.68834	610	185.92837	660	201.16840	710	216.40843
1	155.75311	1	170.99314	1	186.23317	1	201.47320	1	216.71323
2	156.05791	2	171.29794	2	186.53797	2	201.77800	2	217.01803
3	156.36271	3	171.60274	3	186.84277	3	202.08280	3	217.32283
4	156.66751	4	171.90754	4	187.14757	4	202.38760	4	217.62763
5	156.97231	5	172.21234	5	187.45237	5	202.69241	5	217.93244
6	157.27711	6	172.51715	6	187.75718	6	202.99721	6	218.23724
7	157.58192	7	172.82195	7	188.06198	7	203.30201	7	218.54204
8	157.88672	8	173.12675	8	188.36678	8	203.60681	8	218.84684
9	158.19152	9	173.43155	9	188.67158	9	203.91161	9	219.15164
520	158.49632	570	173.73635	620	188.97638	670	204.21641	720	219.45644
1	158.80112	1	174.04115	1	189.28118	1	204.52121	1	219.76124
2	159.10592	2	174.34595	2	189.58598	2	204.82601	2	220.06604
3	159.41072	3	174.65075	3	189.89078	3	205.13081	3	220.37084
4	159.71552	4	174.95555	4	190.19558	4	205.43561	4	220.67564
5	160.02032	5	175.26035	5	190.50038	5	205.74041	5	220.98044
6	160.32512	6	175.56515	6	190.80518	6	206.04521	6	221.28524
7	160.62992	7	175.86995	7	191.10998	7	206.35001	7	221.59004
8	160.93472	8	176.17475	8	191.41478	8	206.65481	8	221.89484
9	161.23952	9	176.47955	9	191.71958	9	206.95961	9	222.19964
530	161.54432	580	176.78435	630	192.02438	680	207.26441	730	222.50445
1	161.84912	1	177.08915	1	192.32918	1	207.56922	1	222.80925
2	162.15392	2	177.39395	2	192.63398	2	207.87402	2	223.11405
3	162.45872	3	177.69875	3	192.93878	3	208.17882	3	223.41885
4	162.76353	4	178.00356	4	193.24359	4	208.48362	4	223.72365
5	163.06833	5	178.30836	5	193.54839	5	208.78842	5	224.02845
6	163.37313	6	178.61316	6	193.85319	6	209.09322	6	224.33325
7	163.67793	7	178.91796	7	194.15799	7	209.39802	7	224.63805
8	163.98273	8	179.22276	8	194.46279	8	209.70282	8	224.94285
9	164.28753	9	179.52756	9	194.76759	9	210.00762	9	225.24765
540	164.59233	590	179.83236	640	195.07239	690	210.31242	740	225.55245
1	164.89713	1	180.13716	1	195.37719	1	210.61722	1	225.85725
2	165.20193	2	180.44196	2	195.68199	2	210.92202	2	226.16205
3	165.50673	3	180.74676	3	195.98679	3	211.22682	3	226.46685
4	165.81153	4	181.05156	4	196.29159	4	211.53162	4	226.77165
5	166.11633	5	181.35636	5	196.59639	5	211.83642	5	227.07645
6	166.42113	6	181.66116	6	196.90119	6	212.14122	6	227.38125
7	166.72593	7	181.96596	7	197.20599	7	212.44602	7	227.68605
8	167.03073	8	182.27076	8	197.51080	8	212.75083	8	227.99085
9	167.33553	9	182.57557	9	197.81560	9	213.05563	9	228.29565

Lengths—Feet to meters (from 1 to 1000 units)—Continued.

Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.
750	228.00046	800	243.84049	850	259.08063	900	274.32055	950	289.56058
1	228.90628	1	244.14529	1	259.38632	1	274.62635	1	289.86638
2	229.21008	2	244.45009	2	259.69012	2	274.93015	2	290.17018
3	229.51486	3	244.75489	3	259.99492	3	275.23495	3	290.47498
4	229.81966	4	245.05969	4	260.29972	4	275.53975	4	290.77978
5	230.12446	5	245.36449	5	260.60452	5	275.84455	5	291.08458
6	230.42926	6	245.66929	6	260.90932	6	276.14935	6	291.38938
7	230.73406	7	245.97409	7	261.21412	7	276.45415	7	291.69418
8	231.03886	8	246.27889	8	261.51892	8	276.75895	8	291.99898
9	231.34366	9	246.58369	9	261.82372	9	277.06375	9	292.30378
760	231.64846	810	246.88849	860	262.12852	910	277.36855	960	292.60859
1	231.95326	1	247.19329	1	262.43332	1	277.67335	1	292.91339
2	232.25806	2	247.49809	2	262.73812	2	277.97815	2	293.21819
3	232.56286	3	247.80289	3	263.04292	3	278.28295	3	293.52299
4	232.86766	4	248.10770	4	263.34772	4	278.58775	4	293.82779
5	233.17247	5	248.41250	5	263.65252	5	278.89255	5	294.13259
6	233.47727	6	248.71730	6	263.95732	6	279.19735	6	294.43739
7	233.78207	7	249.02210	7	264.26212	7	279.50215	7	294.74219
8	234.08687	8	249.32690	8	264.56692	8	279.80695	8	295.04699
9	234.39167	9	249.63170	9	264.87172	9	280.11175	9	295.35179
770	234.69647	820	249.93650	870	265.17652	920	280.41655	970	295.65659
1	235.00127	1	250.24130	1	265.48132	1	280.72135	1	295.96139
2	235.30607	2	250.54610	2	265.78612	2	281.02615	2	296.26619
3	235.61087	3	250.85090	3	266.09092	3	281.33095	3	296.57099
4	235.91567	4	251.15570	4	266.39572	4	281.63575	4	296.87579
5	236.22047	5	251.46050	5	266.70052	5	281.94055	5	297.18059
6	236.52527	6	251.76530	6	267.00532	6	282.24535	6	297.48539
7	236.83007	7	252.07010	7	267.31012	7	282.55015	7	297.79019
8	237.13487	8	252.37490	8	267.61492	8	282.85495	8	298.09500
9	237.43967	9	252.67971	9	267.91972	9	283.15975	9	298.39980
780	237.74447	830	252.98451	880	268.22452	930	283.46455	980	298.70460
1	238.04928	1	253.28931	1	268.52932	1	283.76935	1	299.00940
2	238.35408	2	253.59411	2	268.83412	2	284.07415	2	299.31420
3	238.65888	3	253.89891	3	269.13892	3	284.37895	3	299.61900
4	238.96368	4	254.20371	4	269.44372	4	284.68375	4	299.92380
5	239.26848	5	254.50851	5	269.74852	5	284.98855	5	300.22860
6	239.57328	6	254.81331	6	270.05332	6	285.29335	6	300.53340
7	239.87808	7	255.11811	7	270.35812	7	285.59815	7	300.83820
8	240.18288	8	255.42291	8	270.66292	8	285.90295	8	301.14300
9	240.48768	9	255.72771	9	270.96772	9	286.20775	9	301.44780
790	240.79248	840	256.03251	890	271.27252	940	286.51255	990	301.75260
1	241.09728	1	256.33731	1	271.57732	1	286.81735	1	302.05740
2	241.40208	2	256.64211	2	271.88212	2	287.12215	2	302.36220
3	241.70688	3	256.94691	3	272.18692	3	287.42695	3	302.66700
4	242.01168	4	267.25171	4	272.49172	4	287.73175	4	302.97181
5	242.31648	5	267.55651	5	272.79652	5	288.03655	5	303.27661
6	242.62128	6	267.86132	6	273.10132	6	288.34135	6	303.58141
7	242.92608	7	268.16612	7	273.40612	7	288.64615	7	303.88621
8	243.23088	8	268.47092	8	273.71092	8	288.95095	8	304.19101
9	243.53568	9	268.77572	9	274.01572	9	289.25575	9	304.49581

Lengths—Meters to feet (from 1 to 1000 units).

[Reduction factor: 1 meter=3.28083333 feet.]

Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.
0		50	164.04167	100	328.08333	150	492.12500	200	656.16667
1	3.28083	1	167.32250	1	331.36417	1	495.40583	1	659.44750
2	6.56167	2	170.60333	2	334.64500	2	498.68667	2	662.72833
3	9.84250	3	173.88417	3	337.92583	3	501.96750	3	666.00917
4	13.12333	4	177.16500	4	341.20667	4	505.24833	4	669.29000
5	16.40417	5	180.44583	5	344.48750	5	508.52917	5	672.57083
6	19.68500	6	183.72667	6	347.76833	6	511.81000	6	675.85167
7	22.96583	7	187.00750	7	351.04917	7	515.09083	7	679.13250
8	26.24667	8	190.28833	8	354.33000	8	518.37167	8	682.41333
9	29.52750	9	193.56917	9	357.61083	9	521.65250	9	685.69417
10	32.80833	60	196.85000	110	360.89167	160	524.93333	210	688.97500
1	36.08917	1	200.13083	1	364.17250	1	528.21417	1	692.25583
2	39.37000	2	203.41167	2	367.45333	2	531.49500	2	695.53667
3	42.65083	3	206.69250	3	370.73417	3	534.77583	3	698.81750
4	45.93167	4	210.97333	4	374.01500	4	538.05667	4	702.09833
5	49.21250	5	214.25417	5	377.29583	5	541.33750	5	705.37917
6	52.49333	6	217.53500	6	380.57667	6	544.61833	6	708.66000
7	55.77417	7	219.81583	7	383.85750	7	547.89917	7	711.94083
8	59.05500	8	223.09667	8	387.13833	8	551.18000	8	715.22167
9	62.33583	9	226.37750	9	390.41917	9	554.46083	9	718.50250
20	65.61667	70	229.65833	120	393.70000	170	557.74167	220	721.78333
1	68.89750	1	232.93917	1	396.98083	1	561.02250	1	725.06417
2	72.17833	2	236.22000	2	400.26167	2	564.30333	2	728.34500
3	75.45917	3	239.50083	3	403.54250	3	567.58417	3	731.62583
4	78.74000	4	242.78167	4	406.82333	4	570.86500	4	734.90667
5	82.02083	5	246.06250	5	410.10417	5	574.14583	5	738.18750
6	85.30167	6	249.34333	6	413.38500	6	577.42667	6	741.46833
7	88.58250	7	252.62417	7	416.66583	7	580.70750	7	744.74917
8	91.86333	8	255.90500	8	419.94667	8	583.98833	8	748.03000
9	95.14417	9	259.18583	9	423.22750	9	587.26917	9	751.31083
30	98.42500	80	262.46667	130	426.50833	180	590.55000	230	754.59167
1	101.70583	1	265.74750	1	429.78917	1	593.83083	1	757.87250
2	104.98667	2	269.02833	2	433.07000	2	597.11167	2	761.15333
3	108.26750	3	272.30917	3	436.35083	3	600.39250	3	764.43417
4	111.54833	4	275.59000	4	439.63167	4	603.67333	4	767.71500
5	114.82917	5	278.87083	5	442.91250	5	606.95417	5	770.99583
6	118.11000	6	282.15167	6	446.19333	6	610.23500	6	774.27667
7	121.39083	7	285.43250	7	449.47417	7	613.51583	7	777.55750
8	124.67167	8	288.71333	8	452.75500	8	616.79667	8	780.83833
9	127.95250	9	291.99417	9	456.03583	9	620.07750	9	784.11917
40	131.23333	90	295.27500	140	459.31667	190	623.35833	240	787.40000
1	134.51417	1	298.55583	1	462.59750	1	626.63917	1	790.68083
2	137.79500	2	301.83667	2	465.87833	2	629.92000	2	793.96167
3	141.07583	3	305.11750	3	469.15917	3	633.20083	3	797.24250
4	144.35667	4	308.39833	4	472.44000	4	636.48167	4	800.52333
5	147.63750	5	311.67917	5	475.72083	5	639.76250	5	803.80417
6	150.91833	6	314.96000	6	479.00167	6	643.04333	6	807.08500
7	154.19917	7	318.24083	7	482.28250	7	646.32417	7	810.36583
8	157.48000	8	321.52167	8	485.56333	8	649.60500	8	813.64667
9	160.76083	9	324.80250	9	488.84417	9	652.88583	9	816.92750

Lengths—Meters to feet (from 1 to 1000 units)—Continued.

Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.
250	820.20833	300	984.25000	350	1,148.29167	400	1,312.33333	450	1,476.37500
1	823.48917	1	987.53083	1	1,151.57250	1	1,315.61417	1	1,479.65583
2	826.77000	2	990.81167	2	1,154.85333	2	1,318.89500	2	1,482.93667
3	830.05083	3	994.09250	3	1,158.13417	3	1,322.17583	3	1,486.21750
4	833.33167	4	997.37333	4	1,161.41500	4	1,325.45667	4	1,489.49833
5	836.61250	5	1,000.65417	5	1,164.69583	5	1,328.73750	5	1,492.77917
6	839.89333	6	1,003.93500	6	1,167.97667	6	1,332.01833	6	1,496.06000
7	843.17417	7	1,007.21583	7	1,171.25750	7	1,335.29917	7	1,499.34083
8	846.45500	8	1,010.49667	8	1,174.53833	8	1,338.58000	8	1,502.62167
9	849.73583	9	1,013.77750	9	1,177.81917	9	1,341.86083	9	1,505.90250
260	853.01667	310	1,017.05833	360	1,181.10000	410	1,345.14167	460	1,509.18333
1	856.29750	1	1,020.33917	1	1,184.38083	1	1,348.42250	1	1,512.46417
2	859.57833	2	1,023.62000	2	1,187.66167	2	1,351.70333	2	1,515.74500
3	862.85917	3	1,026.90083	3	1,190.94250	3	1,354.98417	3	1,519.02583
4	866.14000	4	1,030.18167	4	1,194.22333	4	1,358.26500	4	1,522.30667
5	869.42083	5	1,033.46250	5	1,197.50417	5	1,361.54583	5	1,525.58750
6	872.70167	6	1,036.74333	6	1,200.78500	6	1,364.82667	6	1,528.86833
7	875.98250	7	1,040.02417	7	1,204.06583	7	1,368.10750	7	1,532.14917
8	879.26333	8	1,043.30500	8	1,207.34667	8	1,371.38833	8	1,535.43000
9	882.54417	9	1,046.58583	9	1,210.62750	9	1,374.66917	9	1,538.71083
270	885.82500	320	1,049.86667	370	1,213.90833	420	1,377.95000	470	1,541.99167
1	889.10583	1	1,053.14750	1	1,217.18917	1	1,381.23083	1	1,545.27250
2	892.38667	2	1,056.42833	2	1,220.47000	2	1,384.51167	2	1,548.55333
3	895.66750	3	1,059.70917	3	1,223.75083	3	1,387.79250	3	1,551.83417
4	898.94833	4	1,062.99000	4	1,227.03167	4	1,391.07333	4	1,555.11500
5	902.22917	5	1,066.27083	5	1,230.31250	5	1,394.35417	5	1,558.39583
6	905.51000	6	1,069.55167	6	1,233.59333	6	1,397.63500	6	1,561.67667
7	908.79083	7	1,072.83250	7	1,236.87417	7	1,400.91583	7	1,564.95750
8	912.07167	8	1,076.11333	8	1,240.15500	8	1,404.19667	8	1,568.23833
9	915.35250	9	1,079.39417	9	1,243.43583	9	1,407.47750	9	1,571.51917
280	918.63333	330	1,082.67500	380	1,246.71667	430	1,410.75833	480	1,574.80000
1	921.91417	1	1,085.95583	1	1,249.99750	1	1,414.03917	1	1,578.08083
2	925.19500	2	1,089.23667	2	1,253.27833	2	1,417.32000	2	1,581.36167
3	928.47583	3	1,092.51750	3	1,256.55917	3	1,420.60083	3	1,584.64250
4	931.75667	4	1,095.79833	4	1,259.84000	4	1,423.88167	4	1,587.92333
5	935.03750	5	1,099.07917	5	1,263.12083	5	1,427.16250	5	1,591.20417
6	938.31833	6	1,102.36000	6	1,266.40167	6	1,430.44333	6	1,594.48500
7	941.59917	7	1,105.64083	7	1,269.68250	7	1,433.72417	7	1,597.76583
8	944.88000	8	1,108.92167	8	1,272.96333	8	1,437.00500	8	1,601.04667
9	948.16083	9	1,112.20250	9	1,276.24417	9	1,440.28583	9	1,604.32750
290	951.44167	340	1,115.48333	390	1,279.52500	440	1,443.56667	490	1,607.60833
1	954.72250	1	1,118.76417	1	1,282.80583	1	1,446.84750	1	1,610.88917
2	958.00333	2	1,122.04500	2	1,286.08667	2	1,450.12833	2	1,614.17000
3	961.28417	3	1,125.32583	3	1,289.36750	3	1,453.40917	3	1,617.45083
4	964.56500	4	1,128.60667	4	1,292.64833	4	1,456.69000	4	1,620.73167
5	967.84583	5	1,131.88750	5	1,295.92917	5	1,459.97083	5	1,624.01250
6	971.12667	6	1,135.16833	6	1,299.21000	6	1,463.25167	6	1,627.29333
7	974.40750	7	1,138.44917	7	1,302.49083	7	1,466.53250	7	1,630.57417
8	977.68833	8	1,141.73000	8	1,305.77167	8	1,469.81333	8	1,633.85500
9	980.96917	9	1,145.01083	9	1,309.05250	9	1,473.09417	9	1,637.13583

Lengths—Meters to feet (from 1 to 1000 units)—Continued.

Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.
500	1,640.41667	550	1,804.45833	600	1,968.50000	650	2,132.54167	700	2,296.58333
1	1,643.09750	1	1,807.73917	1	1,971.78083	1	2,135.82250	1	2,299.86417
2	1,646.97833	2	1,811.02000	2	1,975.06167	2	2,139.10333	2	2,303.14500
3	1,650.25917	3	1,814.30083	3	1,978.34250	3	2,142.38417	3	2,306.42583
4	1,653.54000	4	1,817.58167	4	1,981.62333	4	2,145.66500	4	2,309.70667
5	1,656.82083	5	1,820.86250	5	1,984.90417	5	2,148.94583	5	2,312.98750
6	1,660.10167	6	1,824.14333	6	1,988.18500	6	2,152.22667	6	2,316.26833
7	1,663.38250	7	1,827.42417	7	1,991.46583	7	2,155.50750	7	2,319.54917
8	1,666.66333	8	1,830.70500	8	1,994.74667	8	2,158.78833	8	2,322.83000
9	1,669.94417	9	1,833.98583	9	1,998.02750	9	2,162.06917	9	2,326.11083
510	1,673.22500	560	1,837.26667	610	2,001.30833	660	2,165.35000	710	2,329.39167
1	1,676.50583	1	1,840.54750	1	2,004.58917	1	2,168.63083	1	2,332.67250
2	1,679.78667	2	1,843.82833	2	2,007.87000	2	2,171.91167	2	2,335.95333
3	1,683.06750	3	1,847.10917	3	2,011.15083	3	2,175.19250	3	2,339.23417
4	1,686.34833	4	1,850.39000	4	2,014.43167	4	2,178.47333	4	2,342.51500
5	1,689.62917	5	1,853.67083	5	2,017.71250	5	2,181.75417	5	2,345.79583
6	1,692.91000	6	1,856.95167	6	2,020.99333	6	2,185.03500	6	2,349.07667
7	1,696.19083	7	1,860.23250	7	2,024.27417	7	2,188.31583	7	2,352.35750
8	1,699.47167	8	1,863.51333	8	2,027.55500	8	2,191.59667	8	2,355.63833
9	1,702.75250	9	1,866.79417	9	2,030.83583	9	2,194.87750	9	2,358.91917
520	1,706.03333	570	1,870.07500	620	2,034.11667	670	2,198.15833	720	2,362.20000
1	1,709.31417	1	1,873.35583	1	2,037.39750	1	2,201.43917	1	2,365.48083
2	1,712.59500	2	1,876.63667	2	2,040.67833	2	2,204.72000	2	2,368.76167
3	1,715.87583	3	1,879.91750	3	2,043.95917	3	2,208.00083	3	2,372.04250
4	1,719.15667	4	1,883.19833	4	2,047.24000	4	2,211.28167	4	2,375.32333
5	1,722.43750	5	1,886.47917	5	2,050.52083	5	2,214.56250	5	2,378.60417
6	1,725.71833	6	1,889.76000	6	2,053.80167	6	2,217.84333	6	2,381.88500
7	1,728.99917	7	1,893.04083	7	2,057.08250	7	2,221.12417	7	2,385.16583
8	1,732.28000	8	1,896.32167	8	2,060.36333	8	2,224.40500	8	2,388.44667
9	1,735.56083	9	1,899.60250	9	2,063.64417	9	2,227.68583	9	2,391.72750
530	1,738.84167	580	1,902.88333	630	2,066.92500	680	2,230.96667	730	2,395.00833
1	1,742.12250	1	1,906.16417	1	2,070.20583	1	2,234.24750	1	2,398.28917
2	1,745.40333	2	1,909.44500	2	2,073.48667	2	2,237.52833	2	2,401.57000
3	1,748.68417	3	1,912.72583	3	2,076.76750	3	2,240.80917	3	2,404.85083
4	1,751.96500	4	1,916.00667	4	2,080.04833	4	2,244.09000	4	2,408.13167
5	1,755.24583	5	1,919.28750	5	2,083.32917	5	2,247.37083	5	2,411.41250
6	1,758.52667	6	1,922.56833	6	2,086.61000	6	2,250.65167	6	2,414.69333
7	1,761.80750	7	1,925.84917	7	2,089.89083	7	2,253.93250	7	2,417.97417
8	1,765.08833	8	1,929.13000	8	2,093.17167	8	2,257.21333	8	2,421.25500
9	1,768.36917	9	1,932.41083	9	2,096.45250	9	2,260.49417	9	2,424.53583
540	1,771.65000	590	1,935.69167	640	2,099.73333	690	2,263.77500	740	2,427.81667
1	1,774.93083	1	1,938.97250	1	2,103.01417	1	2,267.05583	1	2,431.09750
2	1,778.21167	2	1,942.25333	2	2,106.29500	2	2,270.33667	2	2,434.37833
3	1,781.49250	3	1,945.53417	3	2,109.57583	3	2,273.61750	3	2,437.65917
4	1,784.77333	4	1,948.81500	4	2,112.85667	4	2,276.89833	4	2,440.94000
5	1,788.05417	5	1,952.09583	5	2,116.13750	5	2,280.17917	5	2,444.22083
6	1,791.33500	6	1,955.37667	6	2,119.41833	6	2,283.46000	6	2,447.50167
7	1,794.61583	7	1,958.65750	7	2,122.69917	7	2,286.74083	7	2,450.78250
8	1,797.89667	8	1,961.93833	8	2,125.98000	8	2,290.02167	8	2,454.06333
9	1,801.17750	9	1,965.21917	9	2,129.26083	9	2,293.30250	9	2,457.34417

Lengths—Meters to feet (from 1 to 1000 units)—Continued.

Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.
750	2,460.62600	800	2,624.66667	850	2,788.70833	900	2,952.75000	950	3,116.79167
1	2,463.90668	1	2,627.94780	1	2,791.98917	1	2,956.03068	1	3,120.07260
2	2,467.18667	2	2,631.22833	2	2,795.27000	2	2,959.31167	2	3,123.35333
3	2,470.46750	3	2,634.50917	3	2,798.55083	3	2,962.59250	3	3,126.63417
4	2,473.74833	4	2,637.79000	4	2,801.83167	4	2,965.87333	4	3,129.91500
5	2,477.02917	5	2,641.07083	5	2,805.11250	5	2,969.15417	5	3,133.19583
6	2,480.31000	6	2,644.35167	6	2,808.39333	6	2,972.43500	6	3,136.47667
7	2,483.59083	7	2,647.63250	7	2,811.67417	7	2,975.71583	7	3,139.75750
8	2,486.87167	8	2,650.91333	8	2,814.95500	8	2,978.99667	8	3,143.03833
9	2,490.15250	9	2,654.19417	9	2,818.23583	9	2,982.27750	9	3,146.31917
760	2,493.43333	810	2,657.47500	860	2,821.51667	910	2,985.55833	960	3,149.60000
1	2,496.71417	1	2,660.75583	1	2,824.79750	1	2,988.83917	1	3,152.88083
2	2,499.99500	2	2,664.03667	2	2,828.07833	2	2,992.12000	2	3,156.16167
3	2,503.27583	3	2,667.31750	3	2,831.35917	3	2,995.40083	3	3,159.44250
4	2,506.55667	4	2,670.59833	4	2,834.64000	4	2,998.68167	4	3,162.72333
5	2,509.83750	5	2,673.87917	5	2,837.92083	5	3,001.96250	5	3,166.00417
6	2,513.11833	6	2,677.16000	6	2,841.20167	6	3,005.24333	6	3,169.28500
7	2,516.39917	7	2,680.44083	7	2,844.48250	7	3,008.52417	7	3,172.56583
8	2,519.68000	8	2,683.72167	8	2,847.76333	8	3,011.80500	8	3,175.84667
9	2,522.96083	9	2,687.00250	9	2,851.04417	9	3,015.08583	9	3,179.12750
770	2,526.24167	820	2,690.28333	870	2,854.32500	920	3,018.36667	970	3,182.40833
1	2,529.52250	1	2,693.56417	1	2,857.60583	1	3,021.64750	1	3,185.68917
2	2,532.80333	2	2,696.84500	2	2,860.88667	2	3,024.92833	2	3,188.97000
3	2,536.08417	3	2,700.12583	3	2,864.16750	3	3,028.20917	3	3,192.25083
4	2,539.36500	4	2,703.40667	4	2,867.44833	4	3,031.49000	4	3,195.53167
5	2,542.64583	5	2,706.68750	5	2,870.72917	5	3,034.77083	5	3,198.81250
6	2,545.92667	6	2,709.96833	6	2,874.01000	6	3,038.05167	6	3,202.09333
7	2,549.20750	7	2,713.24917	7	2,877.29083	7	3,041.33250	7	3,205.37417
8	2,552.48833	8	2,716.53000	8	2,880.57167	8	3,044.61333	8	3,208.65500
9	2,555.76917	9	2,719.81083	9	2,883.85250	9	3,047.89417	9	3,211.93583
780	2,559.05000	830	2,723.09167	880	2,887.13333	930	3,051.17500	980	3,215.21667
1	2,562.33083	1	2,726.37250	1	2,890.41417	1	3,054.45583	1	3,218.49750
2	2,565.61167	2	2,729.65333	2	2,893.69500	2	3,057.73667	2	3,221.77833
3	2,568.89250	3	2,732.93417	3	2,896.97583	3	3,061.01750	3	3,225.05917
4	2,572.17333	4	2,736.21500	4	2,900.25667	4	3,064.29833	4	3,228.34000
5	2,575.45417	5	2,739.49583	5	2,903.53750	5	3,067.57917	5	3,231.62083
6	2,578.73500	6	2,742.77667	6	2,906.81833	6	3,070.86000	6	3,234.90167
7	2,582.01583	7	2,746.05750	7	2,910.09917	7	3,074.14083	7	3,238.18250
8	2,585.29667	8	2,749.33833	8	2,913.38000	8	3,077.42167	8	3,241.46333
9	2,588.57750	9	2,752.61917	9	2,916.66083	9	3,080.70250	9	3,244.74417
790	2,591.85833	840	2,755.90000	890	2,919.94167	940	3,083.98333	990	3,248.02500
1	2,595.13917	1	2,759.18083	1	2,923.22250	1	2,087.26417	1	3,251.30583
2	2,598.42000	2	2,762.46167	2	2,926.50333	2	3,090.54500	2	3,254.58667
3	2,601.70083	3	2,765.74250	3	2,929.78417	3	3,093.82583	3	3,257.86750
4	2,604.98167	4	2,769.02333	4	2,933.06500	4	3,097.10667	4	3,261.14833
5	2,608.26250	5	2,772.30417	5	2,936.34583	5	3,100.38750	5	3,264.42917
6	2,611.54333	6	2,775.58500	6	2,939.62667	6	3,103.66833	6	3,267.71000
7	2,614.82417	7	2,778.86583	7	2,942.90750	7	3,106.94917	7	3,270.99083
8	2,618.10500	8	2,782.14667	8	2,946.18833	8	3,110.23000	8	3,274.27167
9	2,621.38583	9	2,785.42750	9	2,949.46917	9	3,113.51083	9	3,277.55250

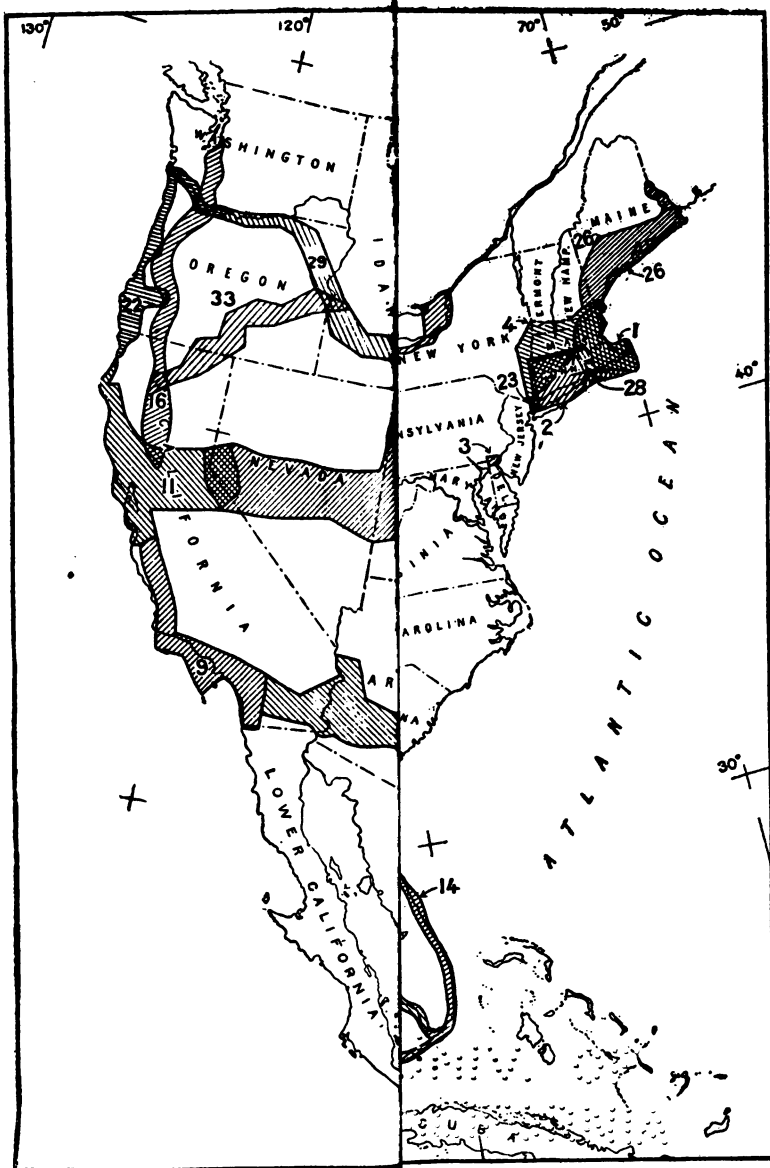


FIG. 1. INDEX MAP SHOWING WHICH HAVE BEEN RIGIDLY

1. Appendix 8, Report for 1885 (super-
seded by Special Publication No.
76).
2. Appendix 8, Report for 1888.
3. Appendix 8, Report for 1893.
4. Appendix 10, Report for 1894 (super-
seded by Special Publication No.
76).
5. Appendix 6, Report for 1901.

27. Special Publication No. 54.
28. Special Publication No. 62.
29. Special Publication No. 74.
30. Special Publication No. 78.
31. Special Publication No. 79.
32. Special Publication No. 86.
33. Special Publication No. 84.

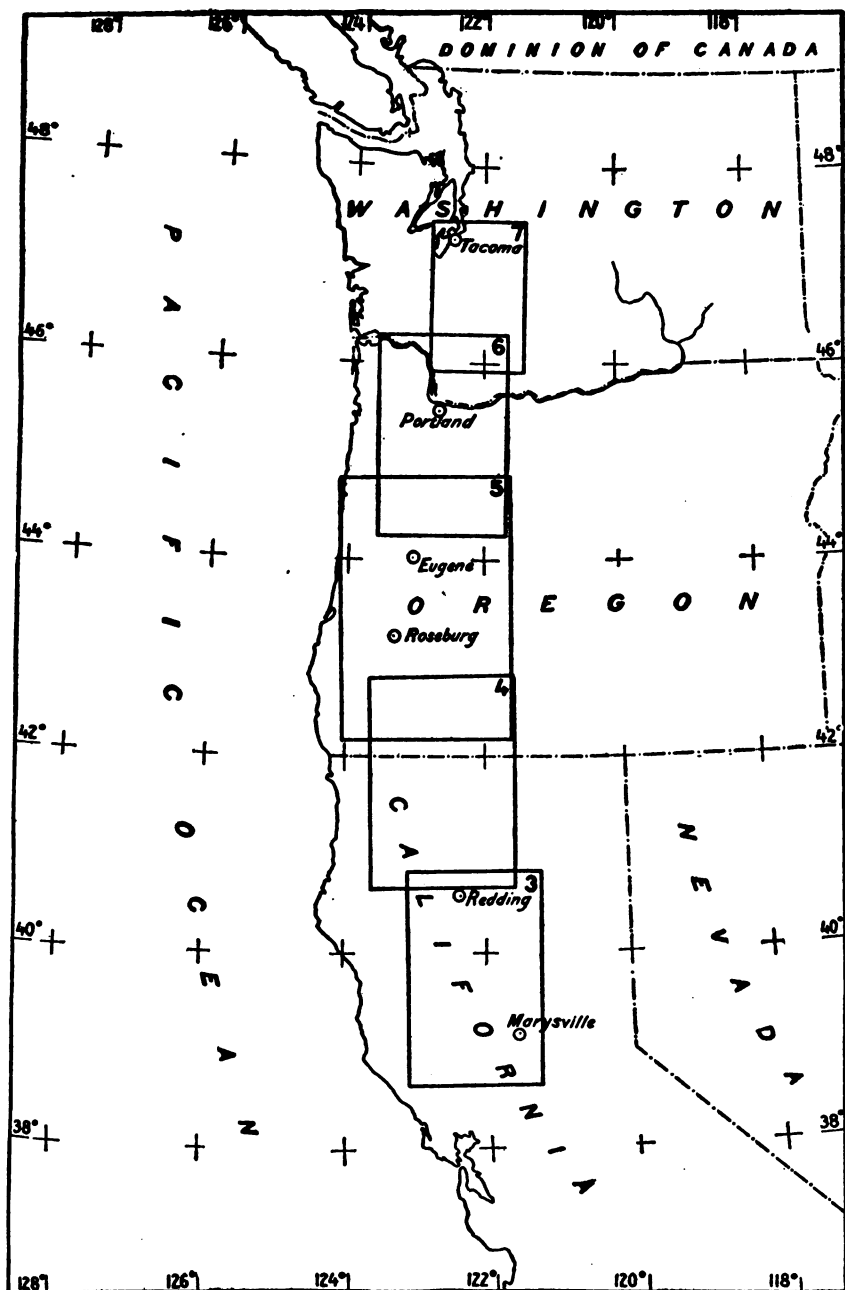


Fig. 2.—INDEX MAP OF THE CALIFORNIA-WASHINGTON ARC.

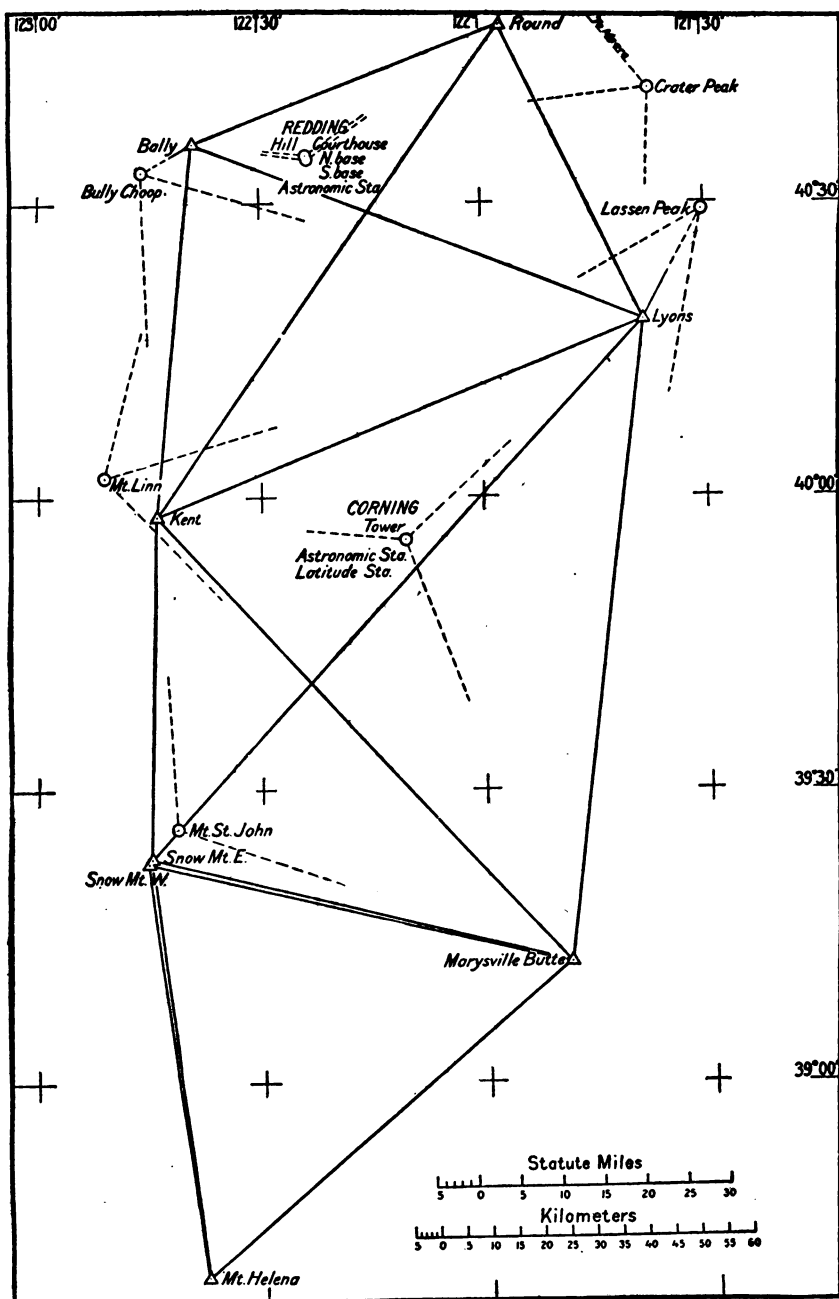


Fig. 3.—TRIANGULATION, THIRTY-THIRD PARALLEL TO VICINITY OF REDDING, CALIF.

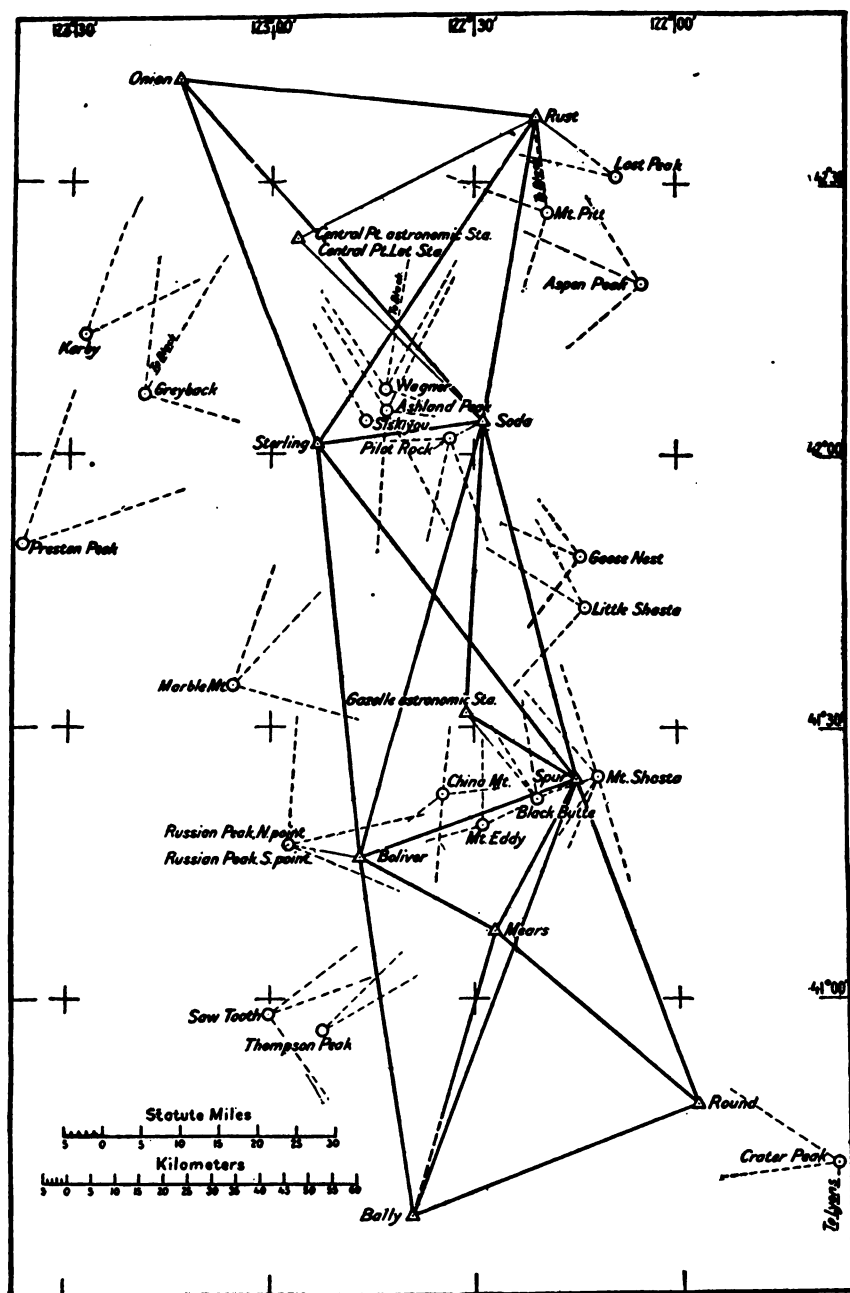


Fig. 4.—TRIANGULATION, VICINITY OF REDDING, CALIF., TO SOUTHERN OREGON,

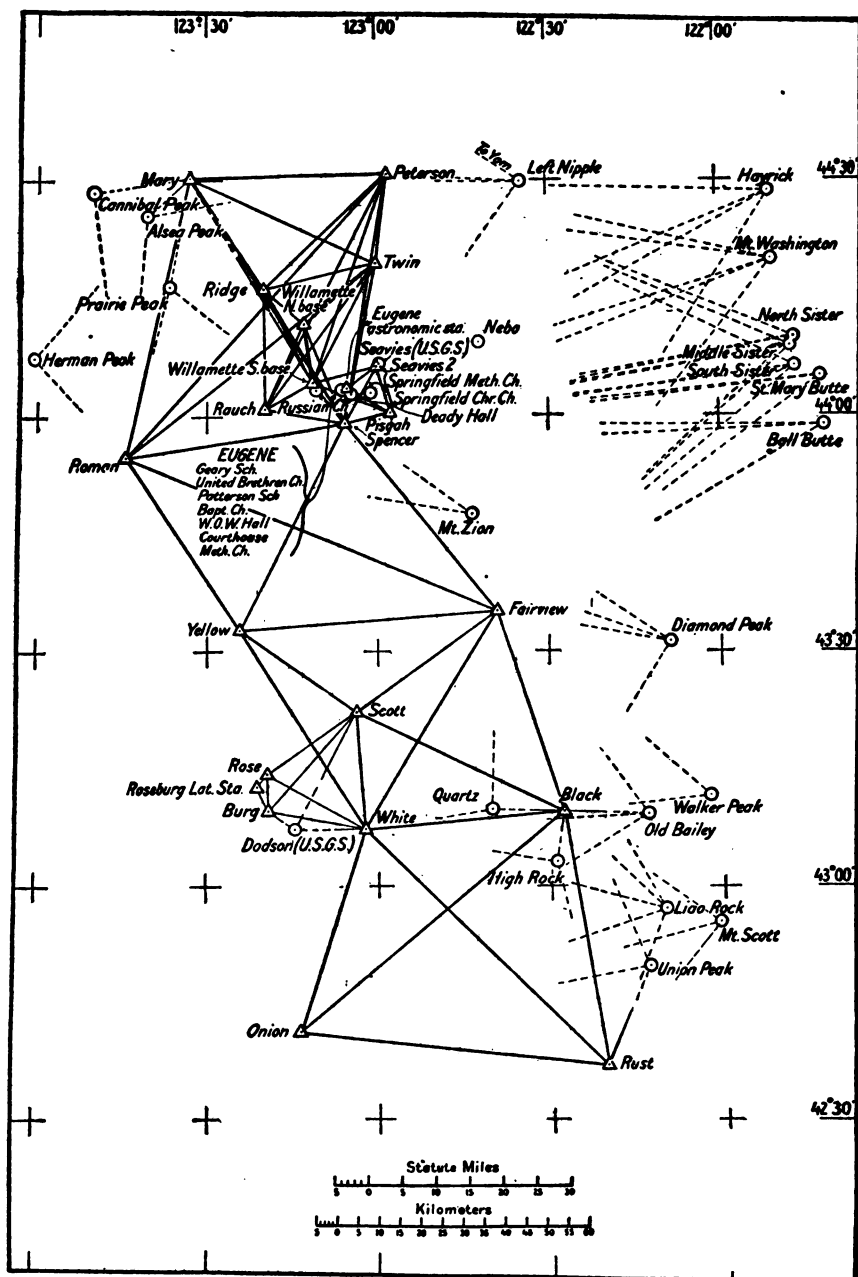


Fig. 5.—TRIANGULATION, SOUTHERN OREGON TO VICINITY OF EUGENE, OREG.

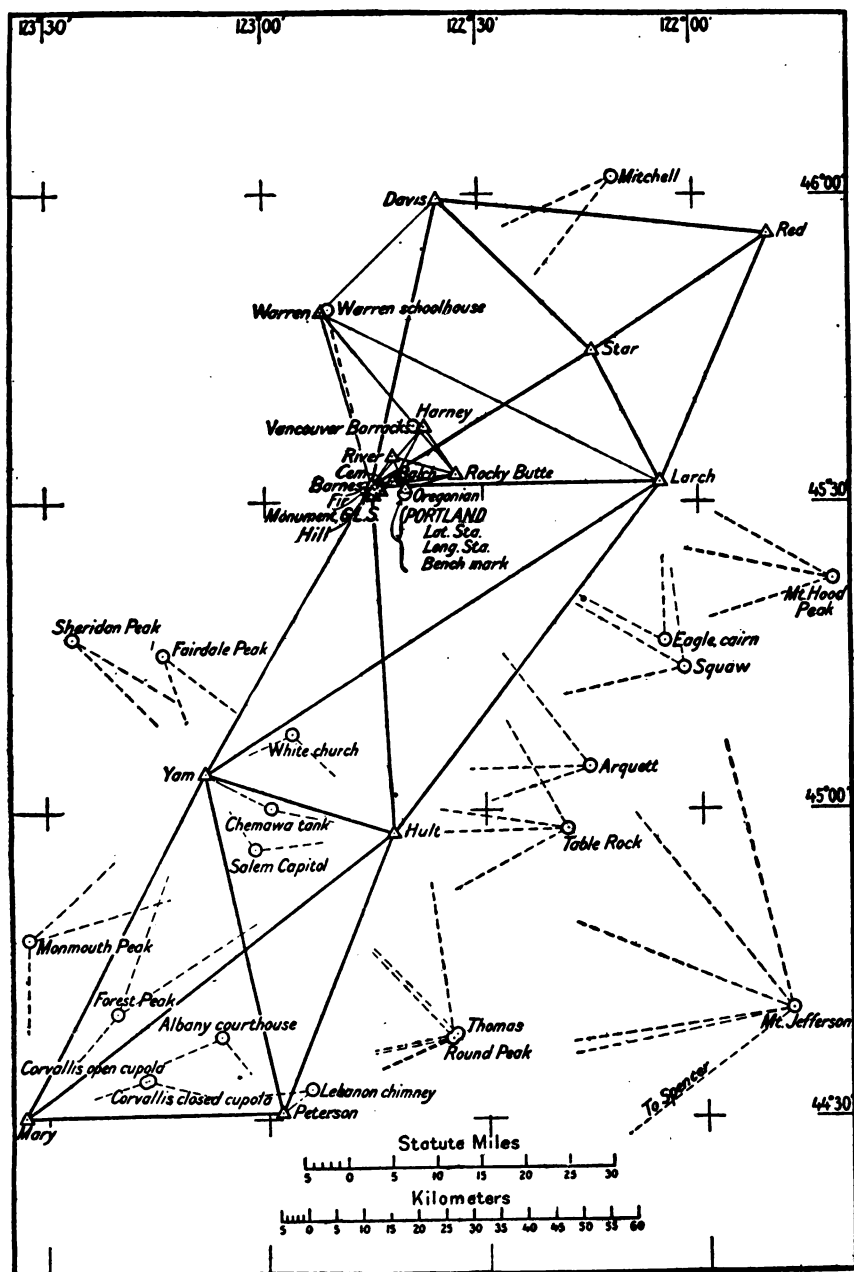


FIG. 6.—TRIANGULATION, VICINITY OF EUGENE, OREG., TO VICINITY OF PORTLAND, OREG.

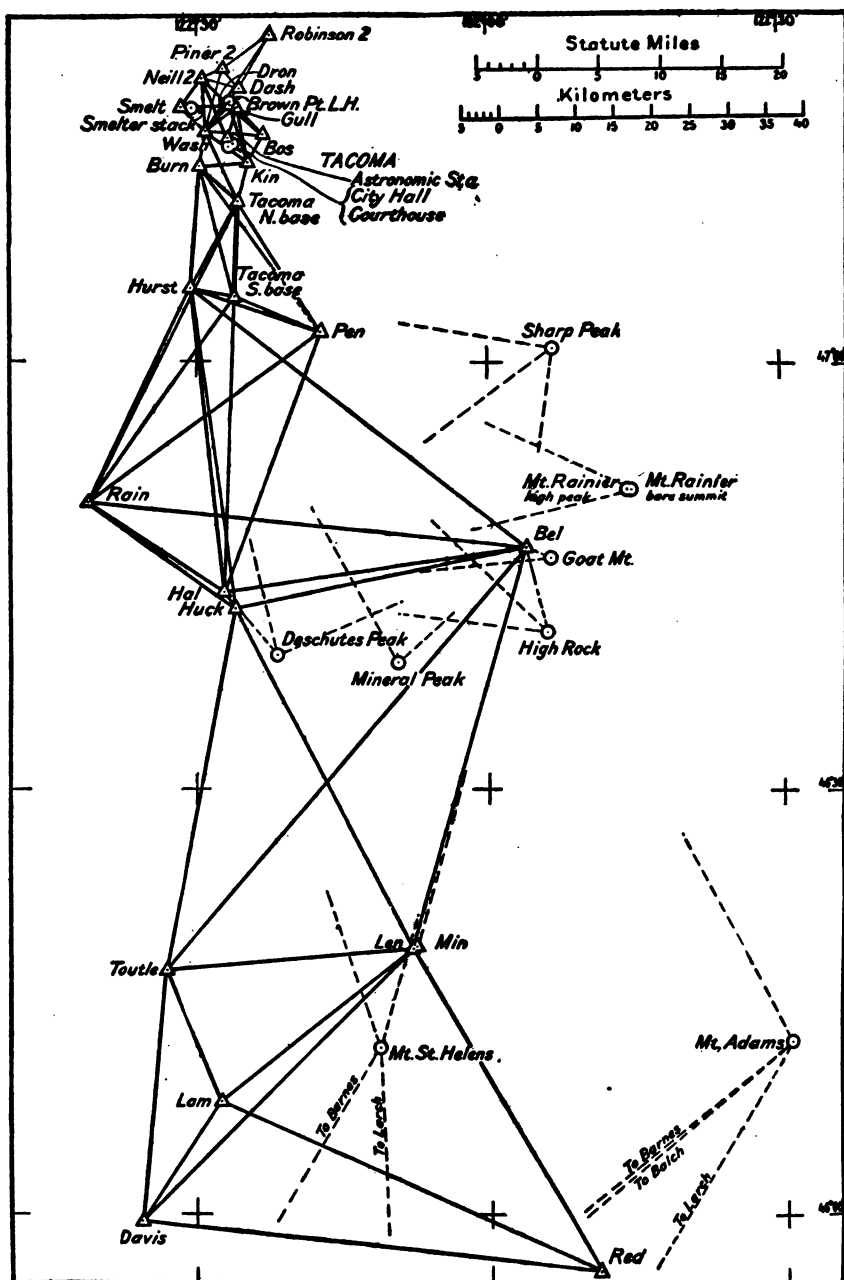


Fig. 7.—TR ANGULATION, VICINITY OF PORTLAND, OREG., TO TACOMA, WASH.

INDEX TO POSITIONS, DESCRIPTIONS, SKETCHES, AND ELEVATIONS.

Station.	Position.	Description.	Sketch.	Elevation.
	Page.	Page.	Number.	Page.
Albany courthouse cupola.....	18		6	22
Alsea Peak, partly cleared, wooded summit.....	18		5	22
Arquett cairn.....	18		6	22
Ashland Peak, cairn.....	15		4	21
Aspen Peak.....	15		4	22
Astronomic station:				
Central Point.....	15	34	4	21
Corning.....	13	34		
Eugene.....	11	29	5	
Gazelle.....	10	25	4	21
Redding.....	13	34	3	21
Tacoma.....	13	33	7	22
Balch.....	19	36	6	
Ball Butte.....	17		5	22
Bally.....	10	24	3, 4	21
Baptist Church spire, Eugene.....	17	35	5	
Barnes.....	12	29	6	22
Bel.....	12	31	7	22
Bench mark, Portland.....	19		6	
Black.....	10	26	5	21
Black Butte, cairn.....	14		4	21
Boliver (Calif.).....	10	25	4	21
Bos.....	13	33	7	22
Brown Point Lighthouse.....	20		7	22
Bully Choop.....	13		3	21
Burg.....	16	35	5	21
Burn.....	13	32	7	22
Cannibal Peak, highest wooded summit.....	18		5	22
Cem.....	19		6	22
Central Point astronomic station.....	15	34	4	21
Central Point latitude station.....	15	34	4	
Chemawa tank.....	18		6	22
China Mountain (not the cairn).....	14		4	21
Christian Church spire, Springfield.....	16	35	5	
City Hall, Tacoma.....	20		7	22
Corning astronomic station.....	13	34	3	
Corning tower.....	13	33	3	
Corvallis, closed cupola.....	18		6	22
Corvallis, open cupola.....	18		6	22
Courthouse:				
Eugene, flagpole.....	17	35	5	
Redding.....	13	34	3	21
Tacoma, cupola.....	20		7	22
Crater Peak.....	14		3, 4	21
Dash.....	20	36	7	22
Davis.....	12	30	6, 7	22
Deady Hall, west tower, Eugene.....	16	35	5	
Deschutes Peak.....	20		7	22
Diamond Peak.....	16		3	22
Dodson (U. S. G. S.).....	16		5	22
Dron.....	13	33	7	22
Eagle, cairn.....	19		6	22
Eugene:				
Astronomic station.....	11	29	5	
Baptist Church spire.....	17	35	5	
Courthouse flagpole.....	17	35	5	
Deady Hall, west tower.....	16	35	5	
Geary School spire.....	16	35	5	
Methodist Church.....	17	35	5	
Patterson School spire.....	17	35	5	
United Brethren Church spire.....	16	35	5	
W. O. W. Hall spire.....	17	35	5	
Fairdale Peak.....	19		6	22
Fairview.....	11	26	5	21
Flr.....	19		6	22
Forest Peak, tallest trees.....	18		6	22
Gazelle astronomic station.....	10	25	4	21
Geary School spire, Eugene.....	16	35	5	
Goat Mountain.....	20		7	22
Goose Nest, tall tree.....	15		4	21
Grayback.....	15		4	21
Gull.....	13	33	7	22

Index to positions, descriptions, sketches, and elevations.—Continued

Station.	Position.	Description.	Sketch.	Elevation.
	Page.	Page.	Number.	Page.
Hal.....	12	31	7	22
Harney.....	19	36	6	22
Hayrick.....	18	36	5	22
Herman Peak, wooded summit.....	17		5	22
High Rock (Oreg.).....	15		5	22
High Rock (Wash.).....	20		7	22
Hill (Calif.).....	14	34	3	
Hill (Oreg.).....	19		6	22
Huck.....	12	31	7	22
Hult.....	12	29	6	22
Hurst.....	12	31	7	22
Kent.....	10	24	3	21
Kerby.....	15		4	21
Kin.....	13	32	7	22
Lam.....	12	30	7	22
Larch.....	12	29	6	22
Lassen Peak.....	13		3	21
Latitude station:				
Central Point.....	15	34	4	
Portland.....	19	36	6	
Roseburg.....	16	35	5	21
Lebanon, tall brick chimney.....	18		6	22
Left Nipple.....	18		5	22
Len.....	12	30	7	22
Liao Rock.....	15		5	22
Little Shasta.....	14		4	21
Longitude station, Portland.....	19	36	6	
Lost Peak.....	15		4	21
Lyons.....	10	24	3	21
Marble Mountain.....	14		4	21
Mary.....	11	27	5, 6	21
Marysville Butte.....	10	24	3	21
Mears.....	10	25	4	21
Methodist Church:				
Eugene.....	17	35	5	
Springfield, spire.....	16	35	5	
Middle Sister.....	17		5	22
Min.....	20		7	
Mineral Peak.....	20		7	22
Mitchell.....	19		6	22
Monmouth Peak.....	18		6	22
Monument, General Land Survey.....	19	35	6	22
Mount Adams.....	19		7	22
Mount Eddy, cairn.....	14		4	21
Mount Helena.....	10	23	3	22
Mount Hood, peak.....	19		6	22
Mount Jefferson.....	18		6	22
Mount Linn.....	13		3	21
Mount Pitt.....	15		4	21
Mount Rainier bare summit.....	20		7	22
Mount Rainier, high peak.....	20		7	22
Mount St. Helens.....	20		7	22
Mount St. John.....	13		3	21
Mount Scott.....	15		5	22
Mount Shasta, top.....	14		4	21
Mount Washington.....	18		5	22
Mount Zion.....	16		5	22
Nebo.....	17		5	22
Neill 2.....	13	33	7	22
North base:				
Redding.....	14	34	3	
Tacoma.....	12	32	7	22
Willamette.....	11	28	5	21
North Sister.....	17		5	22
Old Bailey.....	16		5	22
Onion.....	10	26	4, 5	21
Oregonian.....	19	36	6	22
Patterson School spire, Eugene.....	17	35	5	
Pen.....	12	32	7	22
Peterson.....	11	27	5, 6	21
Pilot Rock.....	15		4	21
Piner 2.....	20	36	7	22
Pisgah.....	11	28	5	
Portland:				
Bench mark.....	19		6	
Latitude station.....	19	36	6	
Longitude station.....	19	36	6	

Index to positions, descriptions, sketches, and elevations.—Continued

Station.	Position.	Description.	Sketch.	Elevation.
	Page.	Page.	Number.	Page.
Prairie Peak, west tree.....	17		5	22
Preston Peak.....	15		4	21
Quartz.....	16		5	22
Rain.....	12	31	7	22
Rauch.....	11	27	5	21
Red.....	12	30	6, 7	22
Redding:				
Astronomic station.....	13	34	3	21
Courthouse.....	13	34	3	21
North base.....	14	34	3	.....
South base.....	14	34	3	.....
Ridge.....	11	27	5	21
River.....	19	35	6	22
Robinson 2.....	20	36	7	.....
Rocky Butte.....	19	36	6	22
Roman.....	11	26	5	21
Rose.....	16	34	5	21
Roseburg latitude station.....	16	35	5	21
Round.....	10	25	3, 4	21
Round Peak.....	18		6	22
Russian Church, cross.....	16		5	.....
Russian Peak, north point.....	14		4	21
Russian Peak, south point.....	14		4	.....
Rust.....	10	26	4, 5	21
St. Mary Butte.....	17		5	22
Salem Capitol, dome.....	18		6	22
Saw Tooth.....	14		4	21
Scott.....	11	26	5	21
Seavies (U. S. G. S.).....	17	35	5	22
Seavies 2.....	11	28	5	.....
Sharp Peak.....	20		7	22
Sheridan Park, highest green tree.....	19		6	22
Siskiyou.....	15		4	21
Smelt.....	13	33	7	22
Smelter stack, 300 feet high.....	20		7	22
Snow Mountain east.....	10	24	3	21
Snow Mountain west.....	10	24	3	21
Soda.....	10	25	4	21
South base:				
Redding.....	14	34	3	.....
Tacoma.....	12	32	7	22
Willamette.....	11	27	5	21
South Sister.....	17		5	22
Spencer.....	11	26	5	21
Springfield:				
Christian Church spire.....	16	35	5	.....
Methodist Church spire.....	16	35	5	.....
Spur.....	10	25	4	21
Squaw, cairn.....	19		6	22
Star.....	12	30	6	22
Sterling.....	10	25	4	21
Table Rock, cairn.....	18		6	22
Tacoma:				
Astronomic station.....	13	33	7	22
City Hall cupola.....	20		7	22
Courthouse cupola.....	20		7	22
North base.....	12	32	7	22
South base.....	12	32	7	22
Thomas, cairn.....	18		6	22
Thompson Peak.....	14		4	21
Toutle.....	12	30	7	22
Twin.....	11	27	5	21
Union Peak.....	15		5	22
United Brethren Church spire, Eugene.....	16	35	5	.....
Vancouver Barracks flagstaff, west.....	19		6	.....
Wagner.....	15		4	21
Walker Peak.....	16		5	.....
Warren.....	12	30	6	22
Warren Schoolhouse cupola.....	19		6	.....
Wash.....	13	33	7	22
White.....	11	26	5	21
White Church spire, west of Brooks.....	19		6	22
Willamette north base.....	11	28	5	21
Willamette south base.....	11	27	5	21
W. O. W. Hallspire, Eugene.....	17	35	5	.....
Yam.....	11	29	6	22
Yellow.....	11	26	5	21

**THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW**

**RENEWED BOOKS ARE SUBJECT TO IMMEDIATE
RECALL**

LIBRARY, UNIVERSITY OF CALIFORNIA, DAVIS

Book Slip-25m-6,'66(G385584)458

Nº 470500

U. S. Coast and
Geodetic Survey.
Special publica-
tion.

PHYSICAL
SCIENCES
LIBRARY

QB301

U5

no.13

1922

LIBRARY
UNIVERSITY OF CALIFORNIA
DAVIS

Call Number:

470500

U. S. Coast and Geodetic
Survey.

Special publication.

QB301

U5

no.13

1922

